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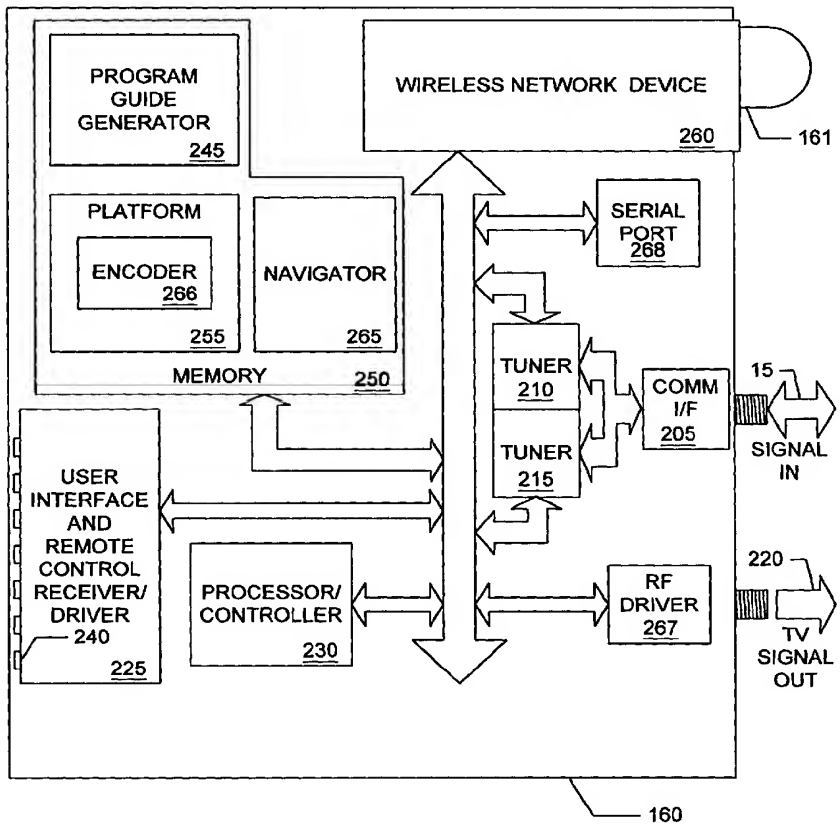

(57) Abstract: A master device interactively distributes a television signal to a remote device for remote display with low latency between a user input and a television signal change.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

NETWORKED SUBSCRIBER TELEVISION DISTRIBUTION

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. provisional patent application No. 60/248,485, entitled "Wireless Remote Display Settop Box" filed on November 14, 2000, which is entirely incorporated herein by reference.

TECHNICAL FIELD

The present invention is generally related to television and its distribution and, more particularly, is related to a system and method for providing an interactive television signal that obviates the need for numerous cable jacks.

BACKGROUND OF THE INVENTION

For many years cable service providers have been in existence providing cable television to millions of subscribers in the United States and around the world. Cable television has become so ubiquitous that the set top box is almost instantly recognizable to the entire American population. Generally, a set top box works by hooking the set top box via a short coaxial (coax) cable into a coax outlet. The coax outlet is generally placed either during the construction of the building, or by the cable company during installation. If the coax outlet is placed during construction of the building, it is likely that there will be a coax outlet in many of the rooms. However, if the outlets are placed during installation, the installer may charge more for each outlet installed, thus forcing the owner to effectively perform a cost-benefit analysis. The coax outlet then typically connects via coax cable to a distribution hub which often serves several different subscribers.

Wireless technologies have developed quickly over the past few years, enabling enormous amounts of data to be pumped through a wireless connection. The Institute for Electronics and Electrical Engineers (IEEE) 802.11b standard enables the user to transfer data at a rate approximately equal to ethernet data rates, about 10Mbps. As such it is

sometimes called wireless ethernet. IEEE 802.11a enables transfer rates of up to 54Mbps. An industry collaboration, Bluetooth 2.0 enables users to transfer data at a rate of about 10Mbps. HomeRF 2.0 is another industry collaboration, backed by a few of the same companies promoting the Bluetooth standard, and like Bluetooth 2.0, has a maximum data transfer rate of about 10Mbps.

Internet video conferencing developed during the same time period, allowing video transfer over the internet. Early internet video conferencing tools used very low quality video, enabling early networks to transfer video. However, technology advances have increased bandwidths, allowing video conferencing tools to become more complex. These video conferencing tools are useful in the business world, where subscribers do not have high expectations when it comes to video quality, synchronization, jitter and latency between encoding and viewing, all of which exist in present video conferencing systems to some extent. However, when it comes to entertainment, subscriber demands are much higher because of the vast array of high quality home entertainment already in the marketplace. These problems cannot be solved by forcing subscribers to lower their expectations, because of the enormous number of other choices providing high quality home entertainment solutions. Thus, there exists a heretofore unaddressed need in the industry.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be better understood with reference to the following drawings. The components in the drawings are not necessarily to scale, emphasis instead being placed upon clearly illustrating the principles of the present invention. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

FIG. 1 is a block diagram of a typical video distribution scheme.

FIG. 1A is a block diagram of an embodiment of the present invention.

FIG. 1B is a block diagram of an alternative embodiment of the present invention.

FIG. 1C is a block diagram of a second alternative embodiment of the present invention.

FIG. 1D is a block diagram of a third alternative embodiment of the present invention.

FIG. 1E is a block diagram of a fourth alternative embodiment of the present invention.

FIG. 2 is a schematic diagram of the master set top box as seen in FIG. 1C and FIG. 1D.

FIG. 2A is a flowchart illustrating the operation of the master set top box as seen in FIG. 2.

FIG. 3 is a schematic diagram of the remote set top box as seen in FIG. 1D.

FIG. 3A is a flowchart illustrating the operation of the remote set top box as seen in FIG. 3.

FIG. 4 is a block diagram illustrating the devices that could house the remote set top box, among others.

FIG. 5 is a flowchart illustrating the operation of the linking between the internet browser and the television viewer.

FIG. 6 is a block diagram illustrating an embodiment of the remote set top box as a wireless distribution hub.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiments of the invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. The invention may, however, be embodied in

many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Furthermore, all "examples" given herein are intended to be non-limiting.

Referring to FIG. 1, a typical video distribution scheme among cable service providers is shown. The headend service provider 1 generally receives a plurality of audio/video (often referred to as video herein) television programs (media content instances) either through a direct connection to another source, or through a satellite communications network. The headend service provider 1 then modulates the plurality of programs into what is ultimately a single audio/video signal. In alternate implementations, broadband multiplexing techniques are used, allowing the plurality of programs to be multiplexed into a plurality of channels, or program streams, prior to being multiplexed again into the single audio/video signal. Furthermore, the headend 1 sends out-of-band signals that implicate interactive program guide applications, and other applications used by the subscriber. The multiplexed audio/video signal is then distributed through a distribution network 5. Ultimately, the multiplexed audio/video signal arrives at the set top box 10, generally through a coax cable 15 running from a drop box to the set top box located in a house. At the set top box a program stream is tuned, decoded (as necessary), and sent to the television 20 for viewing. The distribution system above is modified by the implementation of the various embodiments of the present invention, described hereinafter.

One embodiment of the present invention is generally implemented as a wireless network of set top boxes. Referring to FIG. 1A, one embodiment of a wireless subscriber television system can be seen. In general, this embodiment of the invention comprises a master set top box 100 that receives the multiplexed audio/video signal on connection 15

from a headend service provider 1 (FIG. 1) and outputs an audio/video television signal for communication to a remote laptop computer 101. The master set top box 100, in one example, among others, can be a relatively standard set top box (similar to that seen in FIG. 2, without the network device 110, and having a second RF driver 267 output and being configured to receive remote control commands through a serial connection), which is connected to a computer 102 through a coaxial (coax) cable 113, or other data cable, connected to the output of the master set top box 100.

The computer 102 receives the audio/video signal through a streaming video capture card 103 from the master set top box 100. One example of such a streaming video capture card is an Osprey card, available from ViewCast.com of Dallas, Texas through its Osprey Video division based in Morrisville, North Carolina. The streaming video capture card 103 takes the analog input and converts it to digitized video signal. The card then draws the video signal on a frame buffer 104 of the computer 102 through the processor 105. The frame buffer 104 is located in memory 106, and the frame buffer 104 is normally written to the video card 107 for viewing on a monitor 108. This implementation, however, uses an encoder 109, stored in memory 106, to read the computer frame buffer 104 and uses the encoding software 109 to digitally compress the video signal before sending it to a network card 114. One example of a such encoding software 109 would be Microsoft NetMeeting, which is available from Microsoft Corp. of Redmond, Washington. Further examples of such encoding software include, among others, Windows Media Player, also available from Microsoft Corp. of Redmond, Washington, and RealPlayer, available from RealNetworks, Inc., of Seattle, Washington. In this implementation the network device is an ethernet card 114 attached to an IEEE 802.11b (wireless ethernet) device 110, via an ethernet cable. The wireless ethernet device 110 may be either a peripheral device or a card installed into the computer 102.

After receiving the digitally compressed audio/video signal, the master wireless ethernet device 110 then modulates the audio/video signal and sends it over a wireless link 111 to remote wireless ethernet device 112. The remote wireless ethernet device 112 then demodulates the audio/video signal and transfers it to the laptop computer 101 through an ethernet connection to an ethernet card (not shown) in the laptop. Alternatively, the remote wireless ethernet device 112 could also act as the ethernet card and transfer the audio/video signal to the laptop 101 through a serial port or universal serial bus (USB) connection. The laptop computer 101 is a conventional laptop computer that can include a decoder, implemented in either software or hardware, and decodes the received audio/video signal and writes the decoded video to the laptop display. One skilled in the art would recognize that the remote laptop computer 101 can be replaced by numerous other viewing devices. One such example is a desktop computer which could be connected to the wireless device 112 via USB or peripheral component interconnect (PCI) buses. As one skilled in the art can further imagine, this invention is not limited to merely the IEEE 802.11b communication standard, but may be used on any wireless standard capable of transmitting video quality signals in accordance with this description, e.g. IEEE 802.11a, 802.11g, Bluetooth 2.0, HomeRF 2.0, HiperLAN/2, and Ultra-Wideband, among others, along with proprietary extensions to any of these standards. Moreover, one skilled in the art will recognize that these embodiments can also be extended to wired medium standards, replacing link 111, such as the HomePlug standard which uses existing power lines in a home to transmit a piggyback a high-frequency ethernet-type signal onto a low frequency power signal, and the HomePNA standard which uses the twisted pair wires of the telephone pre-wired into a house to pass data signals.

The master wireless ethernet device 110 is also capable of receiving control signals (e.g. remote control commands), generated by the remote laptop computer 101 in response to user input and transmitted to the master wireless ethernet device 110 by remote laptop wireless ethernet device 112. The master wireless ethernet device 110 demodulates these signals and relays them back to the master set top box 100 through the serial interface 115 via a connection 104 from the computer 102 to a serial port on the master set top box 100. The memory of the computer in this embodiment would further include software to recognize these control signals to relay them to the serial interface 115 for transmission to the master set top box 100.

The wireless ethernet devices 110, 112 described in this embodiment include devices made according to the IEEE 802.11b standard. In general, IEEE 802.11b devices for use with computers have become widely available from a variety of vendors. The IEEE 802.11b standard operates on the two lowest layers of the OSI seven layer model, the data link and physical layers.

At the physical layer lies the radio technology. The wireless ethernet devices 110, 112 operate in the 2.4GHz Industrial, Science and Medical (ISM) band according to a direct sequence spread spectrum (DSSS) protocol. The band varies slightly internationally, but was chosen in part because it does not require licensing in the countries in which it is recognized. The DSSS divides the bandwidth into 14 22-MHz channels, all but three of the channels slightly overlapping the adjacent channels. Data is sent directly across one channel. Noise compensation is allowed through a method called "chipping," whereby each bit of data is converted into a set of redundant bit patterns, called "chips." This redundancy, along with spreading the signal out over 22MHz, provides a sort of error checking and correction that can recover data in many instances without necessitating retransmission.

The DSSS protocol was also chosen for the 802.11b standard because of its higher transmission rate. Frequency hopping spread spectrum, used in some other 802.11 standards, is inherently limited to a bit transfer rate of around 1-2Mbps because of FCC regulations. In comparison, the DSSS method as implemented in 802.11b is capable of about 10-11Mbps. The increase in speed is due in part to the DSSS protocol, however, it is also due in part to the use of complementary code keying (CCK). This method consists of a set of 64 8-bit code words, whose unique mathematical properties allow them to be distinguished from each other, even in the presence of heavy noise. CCK encodes 8 bits per carrier using quadrature phase shift keying modulation and a transfer rate of 1.375 million symbols per second in order to obtain the higher data rate.

The 802.11b data link layer is comprised of two sublayers: the logical link control (LLC) and the media access control (MAC) sublayer. The LLC is the same as other 802 LANs, however, the MAC sublayer is somewhat different from those wireless standards. The MAC uses a carrier sense multiple access (CSMA) protocol much the same as in regular ethernet standards, hence the nickname, wireless ethernet. It is designed to support multiple users by having the sender sense the carrier prior to transmitting a signal.

However, collision detection (CSMA/CD), which is used in regular ethernet applications is not possible. The reason for this lies in the fact that in order to detect a collision the transmitting system must be able to listen and transmit at the same time. Radio systems cannot listen and transmit at the same time because the transmission drowns out the receiver's ability to listen.

Instead, the 802.11b standard uses collision avoidance (CSMA/CA), which attempts to avoid collisions by using packet acknowledgement (ACK). Thus, when a station wants to transmit, it first listens. If the station hears no transmissions it waits an additional random period of time, listens again, and if still no signal is present it

transmits. The transmitting station then listens for an ACK. If no ACK is received, a collision is assumed, and the station again waits a random period of time before transmitting. This process continues until an ACK is received from the target destination.

The MAC sublayer also provides a request to send (RTS) and clear to send (CTS) protocol for operation. In this implementation, when the transmitting station wants to send information, it can send the access point an RTS. The access point then responds with a CTS. Since all devices within the access point's range hear the CTS signal, all other devices stop transmission. This insures that the transmitting station will be allowed to send its signal without collisions caused by transmissions from other end points.

The MAC sublayer provides two final noise resistance features: a cyclic redundancy check (CRC) and packet fragmentation. The CRC is used to detect errors in the transmission of the data by attaching a checksum to the transmission. In normal ethernet, this error checking is handled at a higher level, however, the higher likelihood of error makes the error checking more efficient at the MAC level in 802.11b. Packet fragmentation allows larger packets to be split up into numerous smaller packets. Generally, the larger the packet, the more likely an error is to have occurred during transmission. Therefore, instead of being forced to retransmit the large packing, small packets are used, such that an error in one small packet leads only to the re-transmission of that one small packet.

The final point with regard to the MAC sublayer is that it provides for a so-called point coordination function (PCF), wherein a single point controls access to the media. This is particularly important in this embodiment of the present invention because it provides a sort of quality of service with respect to time-bounded data such as voice and video. Here an access point will allow for a period of time for each station to broadcast

without competition from other endpoints controlled by the access point. This allows for the system to guaranty that a signal will arrive within a certain period of time.

Referring now to FIG. 1B, one can envision a second embodiment of the present invention. Here the computer 102 in FIG. 1A has been eliminated. Input signal encoding is performed inside a master set top box 130 (which is similar to 160, FIG. 2, without the wireless ethernet device, and having a second RF driver 267 output and may not have a second tuner), which converts an audio/video signal received from a headend service provider 1 into a digitally compressed audio/video signal. Alternately, the signal received on the coax cable from the headend service provider 1 could be received in a digitally compressed form, such as MPEG, in which case, there would be no need, in some implementations, for the master set top box 130 to further digitally compress the signal. The compressed digital audio/video signal from the master set top box 130 is connected through a connection 131 (such as a USB connection, among others) to a master wireless ethernet device 110. The master wireless ethernet device 110 then modulates the compressed digital audio/video signal and transmits the compressed digital audio/video signal through a wireless link 111 to a remote wireless ethernet device 112. The remote wireless ethernet device 112 then sends the signal to a remote laptop computer 101, which, through a hardware or software implementation of a decoder, decodes the compressed digital audio/video signal and sends it to the display.

The remote control functions in this embodiment would operate similarly to the previous embodiment, however there would be no computer to act as intermediary, so the signals should be sent in a form that the master set top box 130 will recognize. These commands can be relayed to the master set top box 130 via connection 132, entering the master set top box through a serial port 268 (FIG. 2) for remote control commands.

Referring to FIG. 1C, one can envision eliminating the separate wireless ethernet devices 110, 112 in FIG. 1B, and installing wireless ethernet, for example, capability into the set top boxes themselves. A master set top box 160 is equipped with a wireless network device which transmits the compressed digital audio/video signal via antenna 161 through a wireless link 111 to a remote wireless ethernet device 163. The remote wireless ethernet device 163 in this embodiment takes the form of a PCMCIA card, but one can also envision the full integration of wireless ethernet capability into the laptop computer 101 itself. The PCMCIA card 163, when plugged into the computer, can rapidly demodulate the audio/video signal and communicate the incoming audio/video signal to the laptop computer 101, which then decodes the compressed digital audio/video signal and sends the decoded audio/video signal to the display of the laptop 101. The result in each of these embodiments is a sequence of television pictures (video and audio) on a laptop computer. The wireless system of master and remote set top boxes 160, 170 does not necessitate that the viewing device be in close proximity to a coax cable outlet, thus creating a mobile television viewing apparatus, wherein the viewing device can be moved and carried around while viewing.

Referring to FIG. 1D, one can envision eliminating a household coax cable outlet in favor of a wireless link from a master set top box 160 to a remote set top box 170. The master set top box 160 receives an audio/video signal 15 from the headend service provider 1 and encodes the audio video signal, digitally compressing it, if it is received in analog form. The encoded television signal would then be sent from the master set top box 160 to the remote set top box 170, where it would travel to a television 171 via coax cable 172 connection. This embodiment would also eliminate the inferred requirement that a television be located in close proximity to a coax cable outlet, thus effectively creating a portable television viewing apparatus.

Finally, referring to FIG. 1E, shown is another embodiment of the present invention using, alternatively, the HomePlug or Home phoneline networking alliance (HomePNA) standards. The HomePlug standard, as was discussed earlier, uses pre-existing power-wires to transmit a high frequency signal from one power outlet in a home to another power outlet in a home. This enables home networking without the necessity of opening the walls of the house and putting in new network wiring. The HomePNA standard is similar in that it operates on pre-existing wires in the home, but it uses the telephone wiring instead of the power wiring. Thus, in this embodiment, the master set top box 185 receives the video input signal on connection 15 from the headend 1. The master set top 185 is configured with a network device that uses either the HomePlug or HomePNA standard. When the network device is a HomePlug card, the master set top box will send the information through connection 180 to a normal household power outlet 181. When the network device is a HomePNA card, the master set top box will send the information through connection 180 to a phone jack. The pre-existing wiring (not shown) then carries the signal to every other like outlet in the home. When a remote set top 186 is plugged into another power outlet 183 or telephone jack 184 via connection 185, the signal can be received and demodulated by a HomePlug or HomePNA network device in the remote set top box 186, depending on which card the master set top box 185 uses. The remote set top box 186 can then send the signal to the television 171 for viewing.

Referring now to FIG. 2, a block diagram of one example of the integrated master set top box 160 of the wireless system can be seen. First, a cable signal 15 from the headend service provider 1 is introduced into the master set top box 160 through a communications interface 205 that can, preferably, direct data in both directions, to and from, the headend service provider 1. The incoming cable signal 15 arrives at a tuner 210, which filters out the unwanted source signals (i.e. television stations/programs or

channels) and tunes to a selected television signal, decoding and/or de-scrambling the television signal coming into the master set top box 160, as necessary. In some embodiments the tuner 210 will also include a demultiplexor because the tuned signal actually contains several different "programs," or television signals, multiplexed into the same tuned program stream. A demultiplexor would select the particular station, or television signal, from the channel or program stream that has been tuned.

The master set top box 160 can also include a second tuner 215, such that the master set top box can also transmit an independent signal 220 to a co-located viewing device (e.g. a television), through an RF driver 267. In the case where the master set top box 160 includes a second tuner 215, it can also include an infrared receiver/driver 225, which controls the second tuner 215 through the controller 230. Another embodiment, among others, includes only one tuner 210, an RF driver 267, and an infrared user interface 225 for a remote control, such that the co-located viewing device and remote device receive versions of the same television signal.

The output of the tuner 210 typically goes through an encoder 266, which is, in one implementation, a program residing in memory 250 and running on the platform 255. Alternately, the encoder 266 could be a hardware package installed into the master set top box 160. A hardware package, such as an application specific integrated circuit (ASIC), would likely provide a more high speed solution to the encoder, but would raise costs. When the signal received from the headend service provider 1 is analog, the controller would instruct the encoder 266 to convert the tuned signal to a compressed digital signal that can be transmitted via any of the wireless standards mentioned above. Otherwise, the controller instructs the window manager application to merely write a tuned signal to the wireless interface 260 because the encoding is already present.

In the current embodiment, Microsoft NetMeeting software, executing in memory 250 and 315, is used as the encoder 266 to facilitate the transfer of the video signal. Microsoft NetMeeting uses H.263 encoding, but many other forms of digital compression exist. A few of them easily identifiable are H.323, H.324, MPEG-1, low bit-rate MPEG-2, MPEG-2 and MPEG-4, each of which could be substituted for the H.263 digital compression, but may not achieve the same low latency result achieved in the present embodiment without some modification consistent with the teachings herein.

Video compression is used because of the limited bandwidth in a wireless link. The data rate needed to transfer MPEG-2 video is approximately 4Mbps at the low end. By compressing the data, one can send more data across the link over the same period of time, effectively increasing the data transfer rate. However, in the current implementation using the H.263 compression technology the data transfer rate is approximately 1.5Mbps, considerably lower than MPEG. Consequently the video quality is limited at the remote viewing device, because the same video stream is transferred using less bandwidth. However, wireless links such as 802.11a make high data compression ratios less important, possibly eliminating the need for high compression ratios completely. However, as will be discussed later, the H.263 standard still may be as good of a solution as any with regard to low latency, when changing the channel or requesting the program guide from the master set top box. Alternately, a low bit-rate MPEG-2 encoder could also fulfill the need for low latency at the remote viewing device.

The H.263 standard as used in this application was developed by the International Telecommunications Union. The first means of compression used in H.263 is motion compensation. Motion compensation works for translational motion (i.e. items travelling across the picture, or camera panning), not for zooming or rotational motion within a picture. Compression is achieved here by transferring only a motion vector rather than

transferring the pixel values for the entire picture. However, rather than remaining static, more often there is an error between the frame predicted using only motion vectors and the actual frame. Here a discrete cosine transform method is used to encode the translational errors. This error signal is then sent to the receiving end to enhance the picture received.

The H.263 standard also uses the discrete cosine transform (DCT) to compress the image. In the H.263 standard, a two-dimensional DCT is applied to 8x8 blocks of pixels in the image to be compressed. The coefficients that are achieved are then quantized. This quantization is where the compression actually takes place. Many of the coefficients are very small, and thus become zeros after being quantized. Moreover, the larger DCT coefficients correlate to higher frequency signals. The human eye, however, is less sensitive to high frequency deviations, and therefore, a high quantization factor can be used on these coefficients without sacrificing much in terms of video quality. Thus a large DCT coefficient can effectively be made smaller in order to achieve a higher compression ratio.

The H.263 standard then uses run length encoding to compress the quantized DCT coefficients. Run length encoding encodes a series of consecutive pixels containing the same color as a single codeword. For example, if a series of data contained twelve zeros, the runlength encoding would merely transfer something such as "12 0", rather than transferring twelve separate zeros, "000000000000." Clearly the first method of transferring the number of repeaters and the number repeated takes up less bandwidth than transferring the whole series of numbers. Thus, the compression ratio can be fairly high in situations where there are like color pixels located adjacent to one another.

While the H.263 method is a good standard for achieving high video compression ratios, there are many better standards with respect to video quality. For the most part,

consumers have been satisfied with seeing low quality video in the video conferencing software area, which is why videoconferencing tools are designed for low bit rate and low latency. However, the same consumers are not likely to be so willing to settle for low quality video with respect to the entertainment area in general, and television especially. Recent evidence of consumer demand for high quality video can be seen in the unprecedented rate of acceptance of DVD as the standard in home entertainment systems. Thus higher quality standards like MPEG-1, 2 and 4, along with H.323, H.324 may eventually replace H.263 in the present embodiment.

However, the drawback to replacing H.263 is that the other compression standards use more complicated algorithms that delay the transmission of a new signal from the source. Thus, when the user changes a channel, he/she may not see the effect of the channel change for a few seconds, until the new signal has had a chance to be compressed, transmitted, received and decompressed. High latency in the program change response time is otherwise concerning, and the H.263 solution limits the latency between a requested channel change, program guide or any other request to less than two or three seconds, and preferably to less than one-half second.

The H.263 standard has low latency and, as such, may still be an ideal solution to the latency problem. In an effort to address both the problem of picture quality and the problem with picture latency, an encoder is included in the preferred embodiment that would employ both an H.263 standard and a higher quality standard. MPEG may be the ideal standard for such a situation since it uses the same compression algorithms as H.263. In one sense, H.263 is a lower quality version of the MPEG compression standard.

Alternatively, one skilled in the art would recognize that a low bit-rate MPEG-2 signal could be used in place of the H.263 encoder. The low bit-rate MPEG-2 signal

would be encoded such that there was low latency, in the range of less than a second, between the reception of a user input and the changed signal arriving at a viewing device.

Recognizing this, the encoder 266 at the master set top box could start sending the information immediately, or as soon as a low quality H.263 or low bit-rate MPEG-2 signal could be ready to send. Then, in one embodiment, as the system becomes ready to compress at a higher quality the signal received from the headend service provider 1, the master set top box 160 could start changing the encoding parameters to increase quality. Other embodiments include maintaining the lower quality video compression.

As these encoding parameters are changed, it may be necessary to include a flag in the transmission. The flag would include an information signal containing the proper decoding parameters, such that a decoder in the receiving device 101, 163, 170, 186 could properly decode the signal. This information signal could be included in a header packet, out-of-band data packet, or any other location where it might be possible to include overhead information to be sent to the receiving device. Such a flag could comprise a predetermined bit pattern of sufficient length, followed by the parameters used to decode a certain audio/video packet received, and ending with the same predetermined bit pattern. Since the video bit rate is typically lower than the channel capacity, there is extra bandwidth left over for this type of information. Alternatively, the decoder at the receiving device may include some sort of digital signal processor algorithm that recognizes the digital encoding parameters of the sent signal and decodes the signal accordingly.

One can envision many different possible alternatives to the embodiment disclosed above. One possible option could include two different audio/video signals that are simultaneously transmitted to the remote set top box (or other receiving device) on different frequency, time-division, or code-division channels, depending upon the system.

The controller at the remote set top box would decide to show the H.263 or low bit-rate MPEG-2 signal for a period of time immediately following a change of channel or other request. Then, at some point in time, after the higher quality video signal has finished encoding and started transmitting, the controller at the remote set top box could then splice together the higher quality signal into the lower quality signal. This splicing would occur after the decoding of the audio/video signal, and gradually the lower quality signal would be removed, leaving only the high quality signal to be displayed.

Another method that can be envisioned could use a process whereby a single high quality compression signal is created and transmitted. However, since the encoder 266 and decoder of the high quality compression will take more time from the total time budget, time must be cut from the budget in other places. The most effective location to cut time use is in a decoder input buffer (not shown). The input buffer might be completely eliminated immediately after a user input. Thus, the delay associated with the input buffer is reduced. While the signal is being immediately transferred to the screen, the input buffer can be reinstated, removing its susceptibility to the jitter problems normally associated with small input buffers. One or more of these methods may be used in solutions to the need for low latency in a distribution system.

A further option would exist where the video input signal on connection 15 from the headend service provider is already MPEG-2 encoded. In this environment, the master set top box 160 could pass the signal directly to the wireless network device 260 after tuning 210. Alternatively, the master set top box could re-encode the video input signal after tuning to a lower bit-rate encoding format. The lower bit-rate encoding format could take the form of either H.263 or a low-bit-rate version of MPEG-2, among others. Either of these methods, among others, can transfer the audio/video signal to the remote set top box 170.

After digitizing and compressing the data, the encoder 266 residing on the platform 255 then preferably sends the encoded signal to an optional encryption device (not shown) also residing in memory 250, running on the platform 255. The encryption device is used so that the communications of the television signal cannot be intercepted and bootlegged without permission. Many encryption systems can be used, an acceptable example of which is discussed in U.S. Patent No. 6,157,719, filed July 31, 1998, entitled Conditional Access System, which is hereby incorporated by reference.

After the encryption, the controller 230 sends the audio/video signal to the wireless ethernet module 260, which is preferably capable of transferring up to 10Mbps. Alternatively, this module can also be a fast wireless ethernet (IEEE 802.11a) module capable of transferring up to 54Mbps, an IEEE 802.11g module capable of transferring over 20Mbps, a Bluetooth 2.0 module capable of transferring up to 10Mbps, a HomeRF 2.0 module capable of transferring up to 10Mbps, an Ultra-Wideband module, or any other network device designed to transmit video quality signals (i.e. greater than about 4-5Mbps). The wireless ethernet module 260 modulates the signal and sends it through antenna 161 to remote set top box 170.

Controller 230 can also be configured to receive control signals from the remote set top box through a wireless interface 260 in the master set top box 160. Another method for a user to enter commands is the user interface 225, which allows the user to control the master set top box 160 with buttons 240 on the front of the set top box. The functionality for the remote control located at the remote set top box is discussed in more detail below.

Another feature that can be added to the present embodiment is an interactive program guide. When present, program guide generator 245 is preferably an application that resides in memory 250 that can generate the interactive program guide output for a

co-located television or viewing device. Moreover, in one embodiment the program guide generator 245, generates the program guide for the remote set top box viewing device as well as for the master set top box 160. When a user command is received at the controller 230 requesting the program guide, the controller 230 can use the program guide application 245 with an associated program information database (not shown) residing in the memory 250 to generate the program guide output and instruct a window manager application (also residing in memory and running on a platform 255) to write the signal to the viewing device.

The program guide generator 245, preferably, works by receiving a broadcast file system (BFS) signal from the headend service provider 1 that continuously updates the database in the program guide generator 245. It does this according to a sort of carousel method, continuously providing program information over and over again. When a set top box wants to get particular information, it waits until the particular information comes around on the carousel BFS signal, and then downloads the information. As one skilled in the art will recognize, alternatively, instead of passing the program guide as an image representation to the remote set top box 170, the system could be configured to pass only the contents of the program information database to the remote set top box 170, thus saving bandwidth. Further bandwidth savings can be achieved by transmitting only a portion of the program information database, as needed by a user of the remote set top box 170. Of course, in either case, remote set top box 170 would run an application to interpret and display the interactive program guide.

Referring now to FIG. 2A, shown is a flowchart further illustrating the operation of the master set top box 160 (FIG. 1D). First, the master set top box 160 receives a multiplexed video signal 270 from the headend service provider 1 (FIG. 1). The master set top box then determines whether or not the video input signal corresponding to the

currently tuned television programming (media content instance) is a digital signal 271. If the signal is not a digital signal, the flowchart illustrates that the master set top box 160 senses whether or not a program stream change has been selected 272. If there has been a program stream change, the tuner 160 tunes a new station 273, otherwise the tuner continues tuning the same program stream 274. Next, the video signal is encoded 275. If the encoding occurs soon after a program stream change, in some embodiments the encoder encodes the signal in a low quality video format. After, a period of time without a channel change, or a period allowing a higher quality video signal to be encoded, the signal is encoded in the higher quality format. After encoding the video signal, the signal is optionally encrypted 276, depending on the embodiment. Finally, the signal is transmitted 277, and the process starts over again. Returning to the digital video signal test 271, the master set top box 160 tests whether there has been a program stream change 278. If there has been a program stream change, the new program stream is tuned 279, otherwise, the master set top box continues tuning the same program stream 280. The digital signal is then optionally encrypted 276 and/or re-encoded to a lower bit-rate encoding 281, depending upon the embodiment, and transmitted to the remote set top box 277. In other words, one or both of steps 276 and 281 are omitted in some embodiments. Furthermore, the steps of the process of FIG. 2A may be combined or altered in other embodiments to accomplish one or more of the functions described above.

Referring now to FIG. 3, the remote set top box 170 receives the wireless signal through antenna 300, which in the case of a wireline transmission system would be a communications interface. The wireless ethernet device 305 then demodulates the signal such that the output of the wireless ethernet device 305 is essentially a duplication of the input signal at the wireless ethernet interface 260 (FIG. 2) of the master set top box 160. The output signal from the wireless ethernet interface 305 can then be de-scrambled, if it

was scrambled at the master set top box 160. After de-scrambling, the signal is then able to be decoded 340. Each of these functions reside on the platform 310 in memory 315, but could also be implemented in hardware.

The decoder 340 can be used in any of three ways, according to the viewing device attached. The first embodiment converts the compressed digital signal into an analog audio/video signal. The second embodiment of the decoder 340 exists in the event that the remote viewing device is a digital viewer without decompression capability. Finally, there is the case where the remote viewing device comprises the capability to handle digitally compressed audio/video signals such as H.263, H.323, H.324, etc.

The first embodiment is used when the remote viewing device is an analog viewing device, such as a standard television. In such a situation a window manager (not shown), residing in memory 315, will output a radio frequency (RF) signal to the coaxial connection 320, leading to the television set, after the decoder decompresses the received compressed digital television signal.

In the embodiment where the remote viewing device is digital, but contains no software allowing the device to view compressed digital video, the signal is merely decompressed. The decompressed digital signal is sent to the viewing device through coax connection 320, which can alternatively be an RCA connection, or any other baseband signal transference device. The coax connection 320 is driven by RF driver 345 where the signal can be processed and sent to a monitor, typically via a high-rate connector such as a video graphics array (VGA) connector or digital video interface (DVI) connector. Alternatively, the digital viewing device, such as an LCD, for example, can be driven directly by the digital signal without an intervening connector.

Finally, in the case where the remote viewing device is a device such as a properly configured laptop computer, and the wireless ethernet device is merely a PCMCIA card

with no decoding capability, the signal can be merely sent to the processor of the laptop computer. The processor then uses algorithms stored in memory to decompress the signal, and sends the decompressed digital signal to the video card to be displayed. Alternatively, a hardware playback add-on card which could be used to display the compressed digital data could be used. The add-on card handles decompression without using the processor to perform the decompression. The card delivers full-screen, full-motion, full-color and CD-quality audio at the full National Television Standards Committee (NTSC) video frame rate of 30 frames per second. Hardware playback is generally of much higher quality than the software playback seen using the laptop computer. In another alternative embodiment, a PCMCIA card could provide decompression of the encoded signal with the same advantages of the hardware playback add-on.

The remote set top box 170 may also include an infrared receiver/driver 325. The infrared receiver/driver 325 can be used to receive infrared signals from a remote control device and transfer them to the processor/controller 330. The processor/controller 330 then converts the user input into a control signal. The processor/controller 330 relays these control signals to the wireless ethernet device 305, which in turn sends them to the master set top box 160 (FIG. 2) in order to change the program stream. Alternatively, the processor/controller 330 can also receive user input from the user interface 325. The user interface 325, senses a user input through buttons 335 on the front of the set top box in some embodiments. In alternative embodiments, the user interface could take the form of a keyboard, a mouse or a touch screen, among others, of a laptop or desktop computer, with slight modifications to the user interface 325.

In an alternative embodiment, the remote itself could contain a wireless device transmitting directly to the master set top box 160 (FIG. 2) in order to change the program

stream. In this embodiment the user input might never be sensed at the remote set top box. Instead, a transceiver in the remote control would communicate with the wireless device at the master set top box, rather than relaying the information through the remote set top box.

In the embodiment where the viewing device is a laptop computer, most of these functions can be performed by a software package residing on the computer. For example, as mentioned above, most computers already contain decoding software 340 in memory 315 which allows the user to view video on the laptop computer, a few such example being Microsoft NetMeeting and Windows Media Player available from Microsoft of Redmond, Washington, and Real Player, available from RealNetworks, Inc. of Seattle, Washington. The de-scrambler and user interface 325 can also be embodied in a software solution on the computer, while the controller 330 function can be performed by the processor. One function that is not often replicated by a laptop is the wireless communication device 305. Conceivably, a wireless communication device 305 could be built into hardware in the computer, but generally is not currently available in many laptops. Thus, a wireless communication device 305 would probably have to be added through a peripheral device or PCMCIA card as disclosed in FIGS. 1A, 1B, and 1C.

Referring now to FIG. 3A, shown is a flowchart further illustrating the operation of the remote set top box 170 (FIG. 3). First, the remote set top box 170 receives 350 the encoded signal from the master set top box 160. Then, the signal is tested to see whether it has been encrypted 351. If the signal has been encrypted, it is decrypted 352. Then the signal tested again to determine what type of encoding was used to encode the signal 353 at the master set top box 160. In alternate embodiments, more than one type of encoding is used in order to achieve both low latency and high quality video, thus a choice is illustrated as H.263 encoding or MPEG encoding, though it should be understood that the

choice could be among other formats as well. If the signal has been H.263 encoded, the signal is decoded according to the H.263 algorithm 354. If the signal has been MPEG encoded, the signal is decoded according to the MPEG algorithm 355. The signal is then sent to the viewing device 356, and the process starts over again.

Referring now to FIG. 4, several alternate embodiments of the present system are represented in FIG. 4. Some functionality of the remote set top box 170 is embedded in a TV pad viewing device 400 with a liquid crystal display (LCD) 405. In this configuration the infrared receiver/driver 325 (FIG. 3) is not included in the remote set top box 170 (FIG. 3) . Because the remote set top box 170 is built-in to the structure of a completely mobile viewing device 400, there is less need for a separate remote control, although one may be added with minimal alteration of the TV pad viewing device 400.

Instead, remote control software 410 is imbedded into the TV pad viewing device 400 along with the remote set top box 170. The functionality of the remote control software 410 will be discussed later in this application. The remote control software 410 commands can either be sent straight to the wireless ethernet device 305 (FIG. 3) to be relayed to the master set top box 160, or they may be sent to the controller 330 (FIG. 3) where a control signal can be created and passed along to the wireless ethernet device 305 (FIG. 3). When the master set top box 160 receives the control signal, the wireless ethernet device 260 (FIG. 2) passes the control signal on to the controller 230 (FIG. 2). The controller 230 using the navigator 265 then relays the control signal to the appropriate device, usually the tuner 210 (FIG. 2), if a channel change is requested, for example. The tuner will then change the tuned program stream in response to the control signal. Likewise, when a user requests other settings changes, the controller effects these changes through the function implied, such as changing the volume, which may be handled directly by the viewing device 400, or initiating an interactive program guide,

which could be generated by the master set top box 160 or directly by the viewing device 400 executing the alternate remote set top box 170 functionality, as discussed above.

Another aspect of one embodiment of the invention that can be discussed with reference to the TV Pad embodiment in FIG. 4 is the internet browsing capability 420. This capability can be added to any of the remote set top box embodiments, but is displayed here on a TV pad viewing device 400. Internet browser software 420 is added to the viewing device and has the capability of showing a website along with the television program currently being tuned, thus using the same wired or wireless network for video and internet data.

Internet connectivity is added to the remote set top box in one of several ways. First, the internet connection can be handled by the master set top box 160 (FIG. 1D). The master set top box 160 in that case could contain a cable modem, a standard analog modem, a digital subscriber line (DSL) modem, integrated services digital network (ISDN) modem, an ethernet connection, or any other suitable connection. In this embodiment, the internet browser 420 could be run on the master set top box 160, in which case the signal sent across the link would be the entire picture including the browser.

Alternatively, the internet browser software 420 could be run on the remote set top box. Running the browser software 420 at the remote set top box would reduce the bandwidth necessary to add internet connectivity to the system. Moreover, in some embodiments the remote set top box is housed in a laptop, which would likely already have internet browser software 420 installed.

Another way to add internet connectivity is through the remote set top box functionality. The same methods for connecting the master set top box 160 to the internet can be used to connect the remote set top box 170 to the internet (i.e. cable modem,

analog modem, DSL, etc.). A drawback to this method however, might be a reduction in mobility/portability of the remote set top box 170. However, the reduction in mobility can be counteracted by using wireless modems, which are now widely available, to connect to an internet service provider (ISP).

Another way to give the system internet connectivity is through the remote viewing device 400. In this embodiment, the remote viewing device 400 takes care of the protocol necessary to connect the device to the internet and also has the processing power to run the internet browser 420. The advantage of this method is a reduction in the complexity of the set top boxes 160 and 170, which results in lower costs and allows the user to decide what sort of internet connection is necessary.

Another aspect of one embodiment of the invention to be discussed with reference to the TV Pad 400 is the remote control operation. The screen remote control (remote control pad 410 in FIG. 4) operates substantially differently than an infrared remote and will be discussed in more detail here. In a normal infrared remote control, when a button is pressed, the remote may repeat the command many times until the button is released. Thus a normal set top box will continue to scroll until there are no longer any key-press signals. This mechanism helps to assure that at least one of the control signals sent by the remote will reach the sensor at the set top box, as well a continue scrolling function.

However, in this embodiment of a screen remote control, the user interface 335 may recognize two events based upon the user's actions that will be embodied in the control signal. If, for example, the user presses the channel up button, the first event will be the button being depressed, which will be sensed by the user interface. Then the user interface 335 will create a "channel up pressed" control signal. The "channel up pressed" control signal is then sent to the master set top box 160. The second event recognized by the user interface occurs when the user releases the button after some period of time.

This event will cause the user interface to create a "channel up released" control signal. This event control signal is then sent to the master set top box 160.

In a conventional infrared remote, this configuration would not be very effective, since there is no guarantee that the "channel up released" signal would be sensed at the set top box. Thus with that configuration, the set top box would continue to scroll through program streams indefinitely until it receives a release signal. However, since the protocol used for almost all forms of networking creates an acknowledgment of the receipt of the signal, the "release" signal is more likely to eventually reach the master set top box 160 in this embodiment. Thus, the master set top box 160 will not continue to scroll through program streams indefinitely after the button has been released.

Referring now to the reception of the remote commands at the master set top box 160. First, the master set top box 160 senses whether or not a control signal has been received from the remote set top box 170. Then, after the signals are received by the master set top box 160, the master set top box 160 sends them to the navigator 265 through the controller 230 asking that the command be performed or passed on to an application, such as a watchTV application. The function requested most often is a channel change, although the remote control can contain a plurality of other commands such as, for example, among others, volume change, program guide request, "Pizza on Demand", menu request, etc. In the case where the function is a channel change, the controller 230 would in turn cause the first tuner 210 to perform a channel change by tuning the program stream requested. Additionally, if no "button released" signal is received at the master set top box 160 for a period of time after a "button pressed" signal is received, the navigator 265 will decide that the user intends to signal a second remote operation corresponding to the first command, and perform the operation accordingly.

The navigator 265 continues making this decision to repeat until the button is finally released, and the button-release message is received.

In interpreting the word "button" used in regard to the remote control, a person skilled in the art would recognize that there is no requirement that the "button" be a physical button. Rather, the "button" can be an screen button, such as a touch screen button or a button clickable by a mouse, or any other structure that can sense a user input. Furthermore, it should be clear to one skilled in the art that a normal infrared remote can be used in conjunction with the electronic remote in relaying the infrared signal in the same manner as described above. This can be accomplished through the attachment of an infrared sensor at the remote set top box with almost identical characteristics.

Another embodiment of the remote set top box shown in FIG. 4 is the laptop computer 425. This embodiment was discussed earlier with respect to FIG. 1C. Again, the master set top box 160 communicates with the laptop computer 425 through a network communication device. Here, the network communications device is a PCMCIA card 163 (FIG. 1C) installed in the laptop 425. The laptop computer takes care of the other functions seen on remote set top boxes in other embodiments.

A third embodiment of the remote set top box (also shown in FIG. 1D) involves reconfiguring an existing remote set top box 430 so that it may receive network communications from a master set top box 160. The remote set top box 430 is then connected to the television 435 via a coax cable 440. Thus, a television 435 is no longer required to be located near a cable outlet, so the television is now a portable viewing device in that it can be placed without regard for where the cable outlet is located, and, in some embodiments, can moved without disrupting the cable programming. Moreover, many of the electronics (the tuner, for example) and applications are no longer necessary elements of the remote set top box 430.

A fourth embodiment of the remote set top box 170 is merely an extension of the previous embodiment. Here the remote set top box 170 is an element of a television 445. The remote television 445 acts as both the viewing device and the remote set top box 170, receiving the signals from the master set top box 160 through a small antenna 450.

A fifth embodiment of the remote set top box shown is a personal digital assistant (PDA) 455. The PDA 455 is similar to the TV pad 400 in that they are both comprised of an LCD as the viewing device. One difference between the PDA 455 and the TV pad 400 is that the TV pad 400 is manufactured specifically for watching television, while the PDA 455 is manufactured to be used for multiple purposes. Because of their multi-purpose background, most PDAs 455 come equipped with an expansion slot, such that different cards may be inserted to give the PDA 455 alternate functionality. Here, the PDA 455 is equipped with a remote set top box expansion card which allows it to communicate with the master set top box 160.

Referring now to FIG. 5, a flowchart illustrating a link between the internet browser and the program being watched is shown. This is a further variation of an embodiment of the present invention which involves including a link between the website displayed on the internet browser discussed in regard to FIG. 4 and the television program being tuned by the master set top box 160 (FIG. 1D). In order to do this, the controller 230 (FIG. 2) first senses when a program change has occurred (step 450). Control signals, including channel up/down commands, come through the controller 230 (FIG. 2), therefore, the controller 230 (FIG. 2) has access to know when a program change has occurred.

Next, the controller retrieves the program information from an application like WatchTV running in memory (step 455). Using digital television, the incoming signal contains program information out-of-band signals or information interlaced into the

picture frames. As mentioned above, the interactive program guide generator uses some of these same program information packets when it creates the program guide.

When the program information has been retrieved, the controller performs an internet search using the program information of the program being tuned (step 460). The controller then decides whether any of the websites are relevant websites (step 465). Most search engines define relevant websites in terms of those websites that use the search term from with the highest frequency. Here, the search engine might be instructed only to look for websites that use the search term with a specified frequency. The specified frequency could be a variable determined by the user, it could be fixed, or there may be no specified frequency, wherein the search engine would return any site using the term at least once. The controller then redirects the browser to open the most relevant site found (step 470).

Alternatively, the controller could perform a search on an internal lookup table in order to find a website associated with that channel or program (step 475). If there is a website listed in the lookup table as being associated with the program or channel (step 480), the controller will redirect the website to open that uniform resource locator (URL) (step 485). In a variation of this embodiment, the program guide database sent on the BFS signal may also contain a web link as a database entry associated with each program and/or each channel. Thus, when the program and/or channel are changed, the BFS signal can be transmitted along with the new signal, and the web browser can redirect on receipt of the BFS signal.

The search engine could employ any or all of the methods described above, and perform the methods in any order, such that a website associated with a program or channel can be located. In the case where there is no website found through the internet search, through the lookup table or on the BFS signal, the browser could continue to

browse the current website or automatically redirect to a "home" website that has been defined by the user or is hardwired into the software.

One can imagine numerous alternatives to the above described embodiments. One such embodiment would be to open a website for advertisements associated with the channel being tuned. In another such embodiment, the program itself could send commands for the website browser to change to a particular website at various time intervals. A third embodiment could include switching the order of searches and attempt to tune the website associated with the lookup table prior to attempting an internet search for a website. A fourth embodiment could render the lookup table modifiable by the user to switch to a website of their own choice upon switching to a particular program. In a fifth embodiment, the program could be linked to more than one website requiring another browser to open (i.e. pop-up windows). And many more permutations to the above mentioned scheme would be readily apparent to one skilled in the art.

Referring now to FIG. 6, another alternative embodiment of the distribution system is shown, wherein a set top box 600 acts as a master set top box that can be mounted, for example, on a telephone pole 601 outside the home. From there the master 600 can independently control the signals distributed to one or more house(s) 605(a-d) in the neighborhood in which it is mounted. Essentially, the master set top box 600 performs the function of a distribution hub. Each hub transmitting to one or more remote set top boxes 170(a-d) installed in the neighborhood homes 605(a-d).

The limited number of channels and bandwidth (approximately 10-11Mbps across three channels for wireless ethernet, 10 Mbps on seven channels for Bluetooth 2.0, 54Mbps over 8-12 channels for 802.11a, 22-24Mbps on two-three channels for IEEE 802.11g, 10Mbps on four channels for HomeRF 2.0, and 54Mbps on 19 channels for HiperLAN/2) effectively puts a limit currently on the number of houses that can be served

by one master set top box. A further limit is placed by the signal strength of each of the wireless systems, which can transmit up to about 100 feet. The remote set top box 170 then receives the signal from the master set top box 600. Each tuner contained by the master set top box 600 is independently tunable by the master controller at the request of each remote set top box 170. Thus a single master set top box 600 could deliver a personalized signal to each of the houses 605.

One skilled in the art will recognize that the system described above may also be adapted for intra-home use. The intra-home distribution system would include a master set top box 600 that receives the cable television signal through a coax cable connected to a distribution box outside the home. Here the distribution box is mounted in the attic, however a person having ordinary skill in the art should recognize that the master 600 could be placed anywhere inside or outside of the home. The only relevance of the location of the master 600 is that the remote set top boxes 170(a-d) should be able to pick up the signal being broadcast by the master 600.

The aforementioned programs and software, which comprise an ordered listing of executable instructions for implementing logical functions, can be embodied in any computer-readable medium for use by or in connection with an instruction execution system, apparatus, or device, such as a computer-based system, processor-containing system, or other system that can fetch the instructions from the instruction execution system, apparatus, or device and execute the instructions. In the context of this document, a "computer-readable medium" can be any means that can contain, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device. The computer readable medium can be, for example but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, device, or propagation medium. More

specific examples (a nonexhaustive list) of the computer-readable medium would include the following: an electrical connection (electronic) having one or more wires, a portable computer diskette (magnetic), a random access memory (RAM) (electronic), a read-only memory (ROM) (electronic), an erasable programmable read-only memory (EPROM or Flash memory) (electronic), an optical fiber (optical), and a portable compact disc read-only memory (CDROM) (optical). Note that the computer-readable medium could even be paper or another suitable medium upon which the program is printed, as the program can be electronically captured, via for instance optical scanning of the paper or other medium, then compiled, interpreted or otherwise processed in a suitable manner if necessary, and then stored in a computer memory.

The flowcharts of FIGS. 2A, 3A, and 5 show the architecture, functionality, and operation of a possible implementation of the devices described herein. In this regard, each block represents a module, segment, or portion of code, which comprises one or more executable instructions for implementing the specified logical function(s). It should also be noted that in some alternative implementations, the functions noted in the blocks may occur out of the order noted in the figures. For example, two blocks shown in succession in the figures may in fact be executed substantially concurrently or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved.

It should be emphasized that the above-described embodiments of the present invention, particularly, any "preferred" embodiments, are merely possible examples of implementations, merely set forth for a clear understanding of the principles of the invention. Many variations and modifications may be made to the above-described embodiment(s) of the invention without departing substantially from the spirit and principles of the invention. All such modifications and variations are intended to be

included herein within the scope of this disclosure and the present invention and protected by the following claims.

CLAIMS

Therefore, having thus described the invention, at least the following is claimed:

1. A master device, comprising:

a tuner tuning a television signal from a received multiplexed signal;

an encoder coupled to the tuner and receiving the tuned television signal and digitally encoding the tuned television signal;

a transmitter coupled to the encoder and transmitting the encoded signal to a remote device to be displayed on a viewing device;

a receiver receiving a control signal from the remote device corresponding to a user input; and

a controller coupled to the receiver and configured to accept the control signal from the receiver and instruct the tuner to change the tuned television signal in response thereto, such that the transmitter transmits a changed encoded signal to the remote device for display on the viewing device within three seconds from the remote device receiving the user input.

2. The master device as defined in claim 1, wherein the changed encoded signal is displayed at the viewing device within two seconds from the remote device receiving the user input.

3. The master device as defined in claim 2, wherein the changed encoded signal is displayed at the viewing device within a half-second from the remote device receiving the user input.

4. The master device as defined in claim 3, wherein the transmitter and receiver operate according to a wireline standard selected from the group consisting of HomePlug and HomePNA.

5. The master device as defined in claim 2, wherein the transmitter and receiver operate according to a wireless standard selected from the group consisting of IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, Bluetooth 2.0, HomeRF 2.0, HiperLAN/2, and Ultra-Wideband standards.

6. The master device as defined in claim 5, wherein the video encoder uses a form of digital compression.

7. The master device as defined in claim 6, wherein the video encoder is selected from the group consisting of Microsoft NetMeeting, Windows Media Player, and Real Player.

8. The master device as defined in claim 6, wherein the low latency between the reception of the control signal and the transmission of the changed television signal is achieved by immediately encoding and transmitting a lower quality video signal.

9. The master device as defined in claim 8, wherein a higher quality video signal is transmitted after a period during which the lower quality video signal is transmitted.

10. The master device as defined in claim 9, wherein the period of lower quality video transmission allows the higher quality video signal to be encoded for transmission.

11. The master device as defined in claim 9, wherein the encoding format is at least one of H.263, H.323, H.324, MPEG-1, low bit-rate MPEG-2, MPEG-2 or MPEG-4.

12. The master device as defined in claim 11, wherein the encoding format is low bit-rate MPEG-2 and at least one of H.323, H.324, MPEG-1, MPEG-2 or MPEG-4.

13. The master device as defined in claim 11, wherein the encoding format is H.263 and at least one of H.323, H.324, MPEG-1, MPEG-2 or MPEG-4.

14. The master device as defined in claim 11, wherein the transmitted signal includes an encoding parameter enabling the remote device to decode the transmitted signal using multiple decoding algorithms according to the encoding parameters.

15. The master device as defined in claim 1, wherein the received multiplexed signal further comprises a program information component, and the master device further comprises a program guide generator, receiving the program information from the received multiplexed signal and generating a program guide therefrom that can be transmitted by the transmitter upon a user request for the program guide at the remote device.

16. The master device as defined in claim 1, wherein the system further comprises an internet connection, and the transmitter is capable of transmitting content derived from the internet connection to the remote device.

17. A master device, comprising:

a tuner tuning a digital television signal from a received multiplexed signal;

a transmitter coupled to the tuner and transmitting the tuned digital television signal to a remote device to be displayed on a viewing device;

a receiver receiving a control signal from the remote device corresponding to a user input; and

a controller coupled to the receiver and configured to accept the control signal from the receiver and instruct the tuner to change the tuned digital television signal in response thereto, such that the transmitter transmits the changed tuned digital television signal to the remote device for display on the viewing device within two seconds from the remote device receiving the user input.

18. The master device as defined in claim 17, wherein the changed tuned digital television signal is displayed on the viewing device within a half-second from the user input being received at the remote device.

19. The master device as defined in claim 17, wherein the tuned digital television signal is re-encoded at a lower bit-rate prior to being transmitted to the remote device.

20. The master device as defined in claim 19, wherein the digital television signal is an MPEG-2 signal at a 3Mbps bit-rate, and the re-encoded signal is a lower quality video signal.

21. The master device as defined in claim 20, wherein the re-encoding format is selected from the group consisting of H.263 and low bit-rate MPEG-2.

22. A master device, comprising:

a tuner tuning a television signal from a received multiplexed signal;

a radio frequency driver receiving the tuned television signal and outputting an analog television signal;

a computer, comprising:

a video capture card coupled to the radio frequency driver, receiving the analog television signal and digitizing it for display on a computer monitor;

a NetMeeting program, residing in a memory and running on a processor, receiving the output of the video capture card and compressing the digitized signal

a network device receiving the output of the NetMeeting program, wherein the network device is an IEEE 802.11b wireless ethernet card which modulates and transmits a wireless signal to a remote device with a viewing device, and receives control signals from the remote device corresponding to user input;

an internet connection receiving data from an internet website, which is associated with the tuned television signal, and transferring the data to the network device; and

a controller coupled to the computer and configured to accept the control signals from the computer and instruct the tuner to change the tuned television signal in response thereto such that the transmitter transmits a changed encoded signal to the remote device for display on the viewing device within three seconds from a remote device receiving the user input.

23. A remote device, comprising:

a receiver receiving an encoded video signal from a master device;

a decoder coupled to the receiver and translating the encoded video signal into a decoded video signal suitable for a viewing device;

a user interface receiving a user input and converting it to a control signal; and

a transmitter coupled to the user interface and sending the control signal to the master device to achieve a responsive video signal change within three seconds after receiving the user input.

24. The remote device as defined in claim 23, wherein the transmitter receives a responsive video signal change within two seconds from receiving the user input.

25. The remote device as defined in claim 24, wherein the transmitter receives a responsive video signal change within a half-second from receiving the user input.

26. The remote device as defined in claim 25, wherein the remote device communicates with the master device according to a standard selected from the group consisting of HomePlug and HomePNA.

27. The remote device as defined in claim 25, wherein the remote device communicates with the master device according to a standard selected from the group consisting of the wireless standards IEEE 802.11b, IEEE 802.11a, IEEE 802.11g, Bluetooth 2.0, HomeRF 2.0, HiperLAN/2, and Ultra-Wideband.

28. The remote device as defined in claim 23, wherein the viewing device is a TV Pad with a liquid crystal display.

29. The remote device as defined in claim 28, wherein the remote device is built into the viewing device.

30. The remote device as defined in claim 23, wherein the viewing device is a television.

31. The remote device as defined in claim 30, wherein the remote device is built into the viewing device.

32. The remote device as defined in claim 23, wherein the viewing device is a personal digital assistant.

33. The remote device as defined in claim 32, wherein the remote device is an expansion card compatible with an expansion slot on the personal digital assistant.

34. The remote device as defined in claim 33, wherein the remote device is built into the viewing device.

35. The remote device as defined in claim 23, wherein the viewing device is a laptop computer.

36. The remote device as defined in claim 35, wherein the laptop uses a PCMCIA card to communicate with the master device.

37. The remote device as defined in claim 23, wherein the viewing device and the device are mobile.

38. The remote device as defined in claim 23, wherein the viewing device and the device are portable.

39. The remote device as defined in claim 23, wherein the remote device is an attachment that can be coupled to an existing device.

40. The remote device as defined in claim 23, wherein the encoded television signal received from the remote set top is also encrypted, and the remote device further includes a decryption system coupled to the decoder to decrypt the decoded signal.

41. The remote device as defined in claim 23, wherein the decoder is selected from the group consisting of Microsoft NetMeeting, Windows Media Player, and Real Player.

42. The remote device as defined in claim 23, wherein the encoding format of the encoded video signal is at least one of H.263, H.323, H.324, MPEG-1, low bit-rate MPEG-2, MPEG-2 or MPEG-4.

43. The remote device as defined in claim 42, wherein the encoding format is H.263 immediately after a change video signal command is sensed by the user interface, then changing to at least one of H.323, H.324, MPEG-1, MPEG-2 or MPEG-4.

44. The remote device as defined in claim 42, wherein the encoding format is low bit-rate MPEG-2 immediately after a change video signal command is sensed by the user interface, then changing to at least one of H.323, H.324, MPEG-1, MPEG-2 or MPEG-4.

45. The remote device as defined in claim 42, wherein the encoding format received changes after a period of time has elapsed.

46. The remote device as defined in claim 42, wherein the decoding format is changed according to an encoding parameter flag sent to and sensed by the decoder.

47. The remote device as defined in claim 46, wherein more than one alternate encoding format is used and the encoding parameter flag includes an indication telling the decoder what format to use to decode the signal.

48. The remote device as defined in claim 23, wherein the receiver is also capable of receiving internet data, and the device further comprises a web browser coupled to the receiver, for viewing the internet data.

49. The remote device as defined in claim 48, wherein the encoded video signal received includes a program information component, and the browser uses the program information to link to a website associated with the video signal.

50. The remote device as defined in claim 49, wherein the encoded video signal received includes a television signal information component, and the browser uses the television signal information to link to a website associated with the video signal.

51. A remote device system, comprising:

an IEEE 802.11b wireless ethernet device receiving a modulated television signal, comprising a video stream and an internet stream, from a master wireless ethernet device, and demodulating the television signal;

a decoder coupled to the wireless ethernet device and receiving the demodulated television signal, which decompresses the demodulated television signal;

a user interface for receiving a user input and converting it to a control signal, wherein the user interface is coupled to the IEEE 802.11b wireless ethernet device and transmits it back to the master wireless ethernet device;

a co-located viewing device coupled to the decoder which displays the decompressed television signal, wherein a change requested by a user input is responsive within a half-second of the user input; and

an internet browser coupled to the wireless ethernet device, running on the remote device and receiving the internet stream and displaying the information contained in the internet stream, wherein when a television signal is changed, the internet browser redirects to a web page associated with the changed television signal.

52. A television distribution system comprising:

a remote device comprising:

a first receiver receiving an encoded video signal from a master device;

a decoder coupled to the first receiver and translating the encoded video signal into a decoded video signal suitable for a viewing device;

a user interface receiving a user input and converting it to a control signal;

a first transmitter coupled to the user interface and sending the control signal to the master device to achieve a change in the encoded video signal;

the receiver receives a change in the encoded video signal responsive to the control signal, wherein the remote device sends the change to the viewing device within three seconds of the user input;

a master device comprising:

a tuner tuning a television signal from a received multiplexed signal;

an encoder coupled to the tuner and encoding the tuned television signal;

a second transmitter coupled to the output of the encoder, and sending an encoded video signal to the remote device;

a second receiver receiving the control signal from the remote device; and

a controller coupled to the receiver and configured to accept the control signal from the receiver and instruct the tuner to change the tuned television signal in response thereto, such that the transmitter transmits a changed encoded signal to the remote device for display on the viewing device within three seconds from the remote device receiving the user input.

53. The system as defined in claim 52, wherein the response to the user input is seen at the viewing device within two seconds after the user input is received.

54. The system as defined in claim 53, wherein the response to the user input is seen at the viewing device within a half-second after the user input is received.

55. The system as defined in claim 52, wherein the video encoder uses a form of digital compression.

56. The system as defined in claim 55, wherein the video encoder is selected from the group consisting of Microsoft NetMeeting, Windows Media Player, and Real Player.

57. The system as defined in claim 55, wherein the encoding format is at least one of H.263, H.323, H.324, MPEG-1, low bit-rate MPEG-2, MPEG-2 or MPEG-4.

58. The system as defined in claim 57, wherein the encoding format is H.263 and at least one of H.323, H.324, MPEG-1, low bit-rate MPEG-2, MPEG-2 or MPEG-4.

59. The system as defined in claim 57, wherein the encoding format is low bit-rate MPEG-2 and at least one of H.323, H.324, MPEG-1, MPEG-2 or MPEG-4.

60. The system as defined in claim 52, wherein the multiplexed signal further comprises a broadcast file system signal, and the master device further comprises a program guide generator, receiving the broadcast file system signal, compiling a database therefrom, and generating a program guide therefrom that can be viewed by the viewing device upon a user request for the program guide at the remote device.

61. The system as defined in claim 52, wherein the remote device further comprises a web browser, and the master device comprises an internet connection coupled to the transmitter, allowing the web browser to browse a plurality of websites.

62. The system as defined in claim 52, wherein the remote device further comprises an internet connection coupled to a web browser, allowing the remote device to browse a plurality of websites.

63. The system as defined in claim 52, wherein the master device further comprises a web browser and an internet connection and is capable of transmitting an image of the web browser and website to the remote device.

64. A television distribution system, comprising:

a remote device, comprising:

an IEEE 802.11b wireless ethernet device receiving a modulated television signal from a master device and demodulating the modulated television signal to an encoded video stream and an internet data stream;

a decoder coupled to the output of the wireless ethernet device, and decoding the encoded video stream into a decoded video signal suitable for a viewing device;

a user interface receiving a user input and converting it to a control signal, coupled to the wireless ethernet device sending the control signal to the master device;

a viewing device coupled to the decoder and displaying the decoded video stream, wherein for a change requested by a user input the remote device is responsive within a half-second of the user input;

an internet browser coupled to the internet data stream and displaying the internet data stream, wherein when a program change occurs, the internet browser redirects to a website associated with the changed program;

the master device comprising:

a tuner tuning a television signal from a received multiplexed signal;

a radio frequency driver coupled to the tuner output and outputting an analog television signal;

a computer, comprising:

a video capture card coupled to the radio frequency driver digitizing the analog television signal for display on a computer monitor;

a NetMeeting program, residing in a memory and running on a processor, receiving the output of the video capture card and compressing the digitized signal

a network device coupled to the NetMeeting program, wherein the network device is an IEEE 802.11b wireless ethernet card which modulates and transmits the compressed digitized signal to the remote device, and receives control signals from the remote device corresponding to a user input;

an internet connection coupled to the internet and receiving data from a website, wherein the data

is associated with the tuned television signal, and

transferring the data to the network device; and

a controller coupled to the computer and configured to accept the control signals from the computer and instruct the tuner to change the tuned television signal in response thereto such that the transmitter transmits a changed encoded signal to the remote device for display on the viewing device within three seconds from the remote device receiving the user input.

65. A method of interactively distributing a video signal from a master device, the method comprising the steps of:

receiving a multiplexed signal;

tuning a television signal from the multiplexed signal;

determining whether the tuned television signal is encoded, and encoding the tuned television signal if it is not encoded;

transmitting the encoded tuned television signal to a remote device;

receiving a control signal from the remote device; and

changing the transmitted signal in response to the control signal from the remote device within three seconds of a user input requesting such a change.

66. The method as defined in claim 65, wherein the changed transmitted signal can be displayed at the remote device within two seconds of a user input.

67. The method as defined in claim 66, wherein the changed transmitted signal can be displayed at the remote device within a half-second of a user input.

68. The method as defined in claim 66, wherein the encoding comprises digitally compressing the tuned television signal.

69. The method as defined in claim 68, wherein the encoding is performed by a device selected from the group consisting of Microsoft NetMeeting, Windows Media Player, and Real Player.

70. The method as defined in claim 68, wherein the method further comprises sacrificing video quality by immediately transmitting the encoded tuned television signal in order to achieve low latency between the user input and reception of the changed signal at the remote device.

71. The method as defined in claim 70, wherein the method further comprises increasing the video quality after a delay, wherein the delay allows a higher quality video signal to be encoded for transmission.

72. The method as defined in claim 71, wherein the encoding format is at least one of H.263, H.323, H.324, MPEG-1, low bit-rate MPEG-2, MPEG-2 or MPEG-4.

73. The method as defined in claim 72, wherein the encoding format is H.263 and at least one of H.323, H.324, MPEG-1, low bit-rate MPEG-2, MPEG-2 or MPEG-4.

74. The method as defined in claim 72, wherein the encoding format is low bit-rate MPEG-2 and at least one of H.323, H.324, MPEG-1, MPEG-2 or MPEG-4.

75. The method as defined in claim 72, wherein the transmitted signal includes an encoding parameter, allowing the remote device to decode the transmitted signal using multiple decoding algorithms according to the encoding parameters.

76. The method as defined in claim 65, wherein the multiplexed signal further comprises a program information component, and method further comprises generating a program guide from the information component of the multiplexed signal, transmitting the program guide to the remote device upon user request.

77. The method as defined in claim 65, wherein the method further comprises providing an internet connection, and allowing the remote device to browse the internet using a web browser.

78. The method as defined in claim 65, wherein the method further comprises re-encoding the multiplexed signal if it is already encoded, wherein the re-encoding is at a lower bit-rate digital compression than the multiplexed signal.

79. The method as defined in claim 78, wherein the multiplexed signal is encoded according to an MPEG-2 standard at 3Mbps, and the re-encoding format is a lower bit-rate standard.

80. The method as defined in claim 79, wherein the re-encoding format is H.263 or low bit-rate MPEG-2.

81. A method of interactively distributing a video signal from a master device, the method comprising the steps of:

receiving a multiplexed signal;

tuning a television signal from the multiplexed signal;

sending the tuned television signal to a computer to be digitized by a video capture card and encoded by a NetMeeting program;

using an IEEE 802.11b wireless ethernet device to transmit the encoded signal to a remote device;

receiving a control signal at the IEEE 802.11b wireless ethernet device, from the remote device;

changing the transmitted signal in response to the control signal from the remote device within three seconds of a user input requesting such a change; and

providing an internet connection, and sending the data to the wireless ethernet device, allowing the remote device to browse the internet.

82. A method of interactively receiving a video signal from a wireless master device, the method comprising the steps of:

receiving a first compressed video signal from a master device;

decompressing the first compressed video signal;

sending the first video signal to a viewing device;

receiving a user input corresponding to a requested change in the video signal;

deriving a control signal from the user input;

transmitting the control signal to the master device;

receiving a second compressed video signal from the master device; and

sending the second compressed video signal to the viewing device within three seconds from receiving the user input.

83. The method of claim 82, wherein the second compressed video signal is sent to the viewing device within two seconds of receiving the user input.

84. The method of claim 83, wherein the second compressed video signal is sent to the viewing device within a half-second of receiving the user input.

85. The method of claim 84, wherein the wherein the method for receiving and transmitting are selected from the group consisting of the standards HomePlug and HomePNA.

86. The method as defined in claim 82, wherein the method for receiving and transmitting are selected from the group consisting of the standards IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, Bluetooth 2.0, HomeRF 2.0, HiperLAN/2, and Ultra-Wideband.

87. The method as defined in claim 82, wherein the viewing device is a TV Pad with a liquid crystal display.

88. The method as defined in claim 82, wherein the viewing device is a television.

89. The method as defined in claim 82, wherein the viewing device is a personal digital assistant.

90. The method as defined in claim 82, wherein the viewing device is a laptop computer.

91. The method as defined in claim 90, wherein the method for receiving and transmitting comprises using a PCMCIA card to communicate with the master device.

92. The method as defined in claim 82, wherein the first and second compressed video signals received from the master device are also encrypted, and the method further comprises the step of decrypting the first and second compressed video signals.

93. The method as defined in claim 82, wherein the decompressing is performed by software selected from the group consisting of Microsoft NetMeeting, Windows Media Player, and Real Player.

94. The method as defined in claim 82, wherein the first and second compression formats are at least one of H.263, H.323, H.324, MPEG-1, low bit-rate MPEG-2, MPEG-2 or MPEG-4.

95. The method as defined in claim 94, wherein the first and second compression formats are H.263 and at least one of H.323, H.324, MPEG-1, low bit-rate MPEG-2, MPEG-2 or MPEG-4.

96. The method as defined in claim 94, wherein the first and second compression formats are low bit-rate MPEG-2 and at least one of H.263, H.323, H.324, MPEG-1, MPEG-2 or MPEG-4.

97. The method as defined in claim 94, wherein the first and second compression formats for the received compressed video signals change after a period of time, thus changing the decompression algorithm.

98. The method as defined in claim 94, wherein the decompression format is changed according to an compression parameter flag sent to and sensed when decompressing.

99. The method as defined in claim 98, wherein the decompression format comprises more than one standard, and uses the compression parameter flag includes an indication telling the decompressor what format to use to decompress the signal.

100. The method as defined in claim 82, wherein the method further comprises receiving internet data from the master device, and the using a web browser to view the internet data.

101. The method as defined in claim 100, wherein the first and second compressed video signals received include a program information component, and the method further comprises redirecting to a website that has some correlation to the program information.

102. A method of interactively receiving a video signal from a wireless master device, the method comprising the steps of:

receiving a wireless ethernet modulated signal from a master device, wherein the modulated signal comprises a first compressed video signal and a first internet data signal;

demodulating the first wireless ethernet modulated signal to the component parts;

decompressing the first compressed video signal;

sending the first video signal to a viewing device;

receiving a user input corresponding to a requested change in the first video signal;

deriving a control signal from the user input;

transmitting the control signal to the master device;

receiving a second compressed video signal from the master device;

sending the second compressed video signal to the viewing device within three seconds from receiving the user input;

providing a internet browser, receiving the first internet data signal; and

redirecting the master device to a new website such that the internet browser receives a second internet data signal associated with a change in program after the user input.

103. A method of interactively distributing a video signal from a master wireless device, the method comprising the steps of:

receiving a first compressed video signal at a remote device from a master device;

decompressing the first compressed video signal into a decompressed video signal suitable for a viewing device;

receiving a user input corresponding to a requested change in the video signal;

deriving a control signal from the user input;

transmitting the control signal to the master device;

receiving a second compressed video signal from the master device;

sending the second compressed video signal to the viewing device within three seconds from receiving the user input;

receiving a multiplexed signal;

tuning a tuned television signal from the multiplexed signal;

ensuring the tuned television signal is a first compressed video signal, first compressing the tuned television signal if it has no compression;

transmitting the first compressed video signal to a remote device;

receiving the control signal from the remote device; and

changing the transmitted signal in response to the control signal from the remote device within three seconds of a user input requesting such a change.

104. The method as defined in claim 103, wherein the system further comprises changing the transmitted signal in response to the control signal within two seconds of the user input requesting such a change.

105. The method as defined in claim 104, wherein the system further comprises changing the transmitted signal in response to the control signal within a half-second of the user input requesting such a change.

106. The method as defined in claim 104, wherein the encoding and decoding are performed by software selected from the group consisting of Microsoft NetMeeting, Windows Media Player, and Real Player.

107. The method as defined in claim 103, wherein the half-second period between receiving the user input and receiving the second compressed video signal is achieved by immediately transmitting a low quality video signal.

108. The method as defined in claim 107, wherein the first and second compression formats comprise at least one of H.263, H.323, H.324, MPEG-1, low bit-rate MPEG-2, MPEG-2 or MPEG-4.

109. The method as defined in claim 108, wherein the first and second compression formats comprise H.263 and at least one of H.323, H.324, MPEG-1, low bit-rate MPEG-2, MPEG-2 or MPEG-4.

110. The method as defined in claim 108, wherein the first and second compression formats comprise low bit-rate MPEG-2 and at least one of H.323, H.324, MPEG-1, MPEG-2 or MPEG-4.

111. The method as defined in claim 103, wherein the multiplexed signal comprises a broadcast file system signal, and the method further comprises generating a program guide from the broadcast file system signal, and transmitting the program guide to the remote device upon request.

112. The method as defined in claim 103, wherein the method further comprises the steps of connecting to the internet, and allowing the user to browse a plurality of websites.

113. A method of interactively distributing a video signal from a master wireless device, the method comprising the steps of:

receiving a multiplexed signals;

tuning a television signal from the multiplexed signal;

sending the tuned television signal to a computer to be digitized by a video capture card and encoded by a NetMeeting program;

using an IEEE 802.11b wireless ethernet device to transmit the encoded signal to a remote device;

receiving a control signal at the IEEE 802.11b wireless ethernet device, from the remote device;

changing the transmitted signal in response to the control signal from the remote device within three seconds of a user input requesting such a change;

providing an internet connection, and sending the data to the wireless ethernet device, allowing the remote device to browse the internet;

receiving a wireless ethernet modulated signal from the master device, wherein the signal comprises a first compressed video signal and a first internet data signal;

demodulating the first wireless ethernet modulated signal;

decompressing the first compressed video signal;

sending the decompressed first video signal to a viewing device;

receiving a user input corresponding to a requested change of the first video signal;

deriving a control signal from the user input;

transmitting the control signal to the master device, and receiving a second compressed video signal from the master device within three seconds from receiving the user input;

providing a internet browser, receiving the first internet data signal; and

redirecting the internet browser to receive a second internet data signal associated with a change in program after the user input.

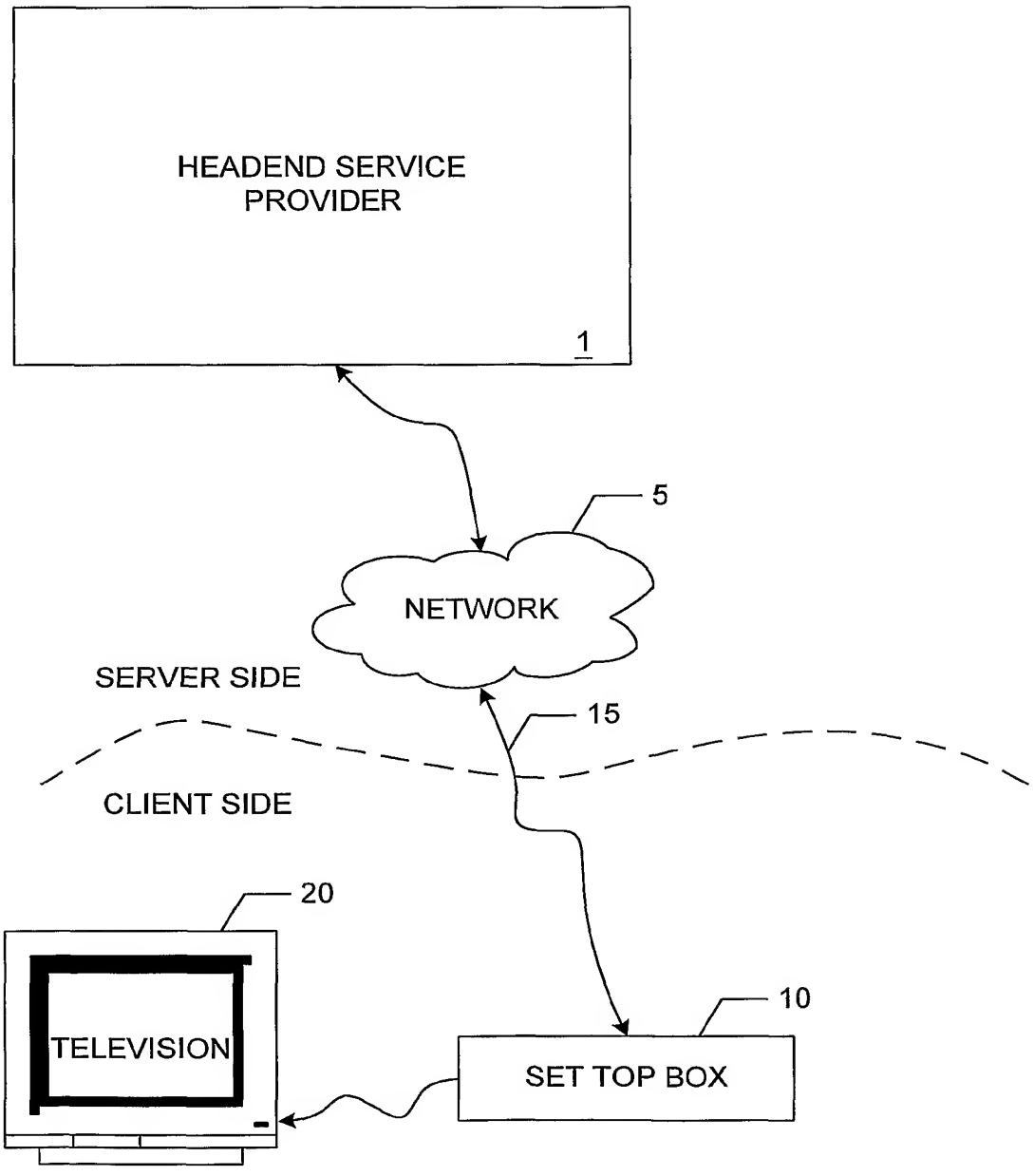
HEADEND SERVICE PROVIDER
1
5
NETWORK
SERVER SIDE
15
CLIENT SIDE
20
TELEVISION
10
SET TOP BOX

FIG. 1

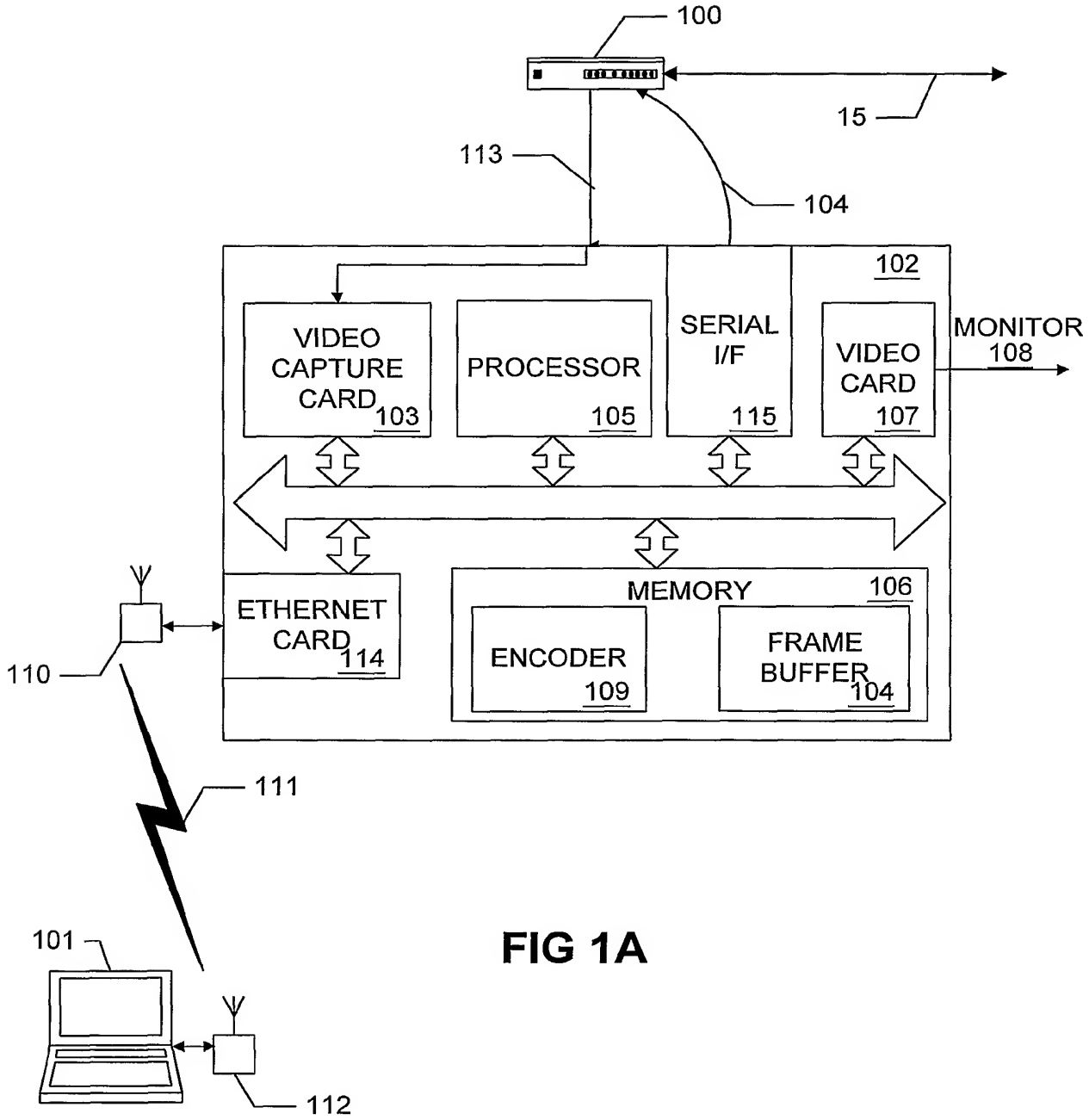
100
15
113
104
102
VIDEO CAPTURE CARD 103
PROCESSOR 105
SERIAL I/F 115
VIDEO CARD 107
MONITOR 108
ETHERNET CARD 114
MEMORY 106
ENCODER 109
FRAME BUFFER 104
110
111
101
112

FIG 1A

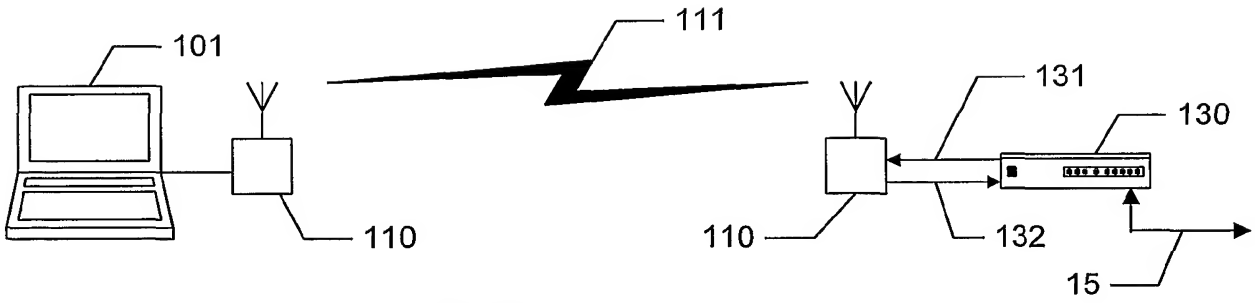

FIG 1B

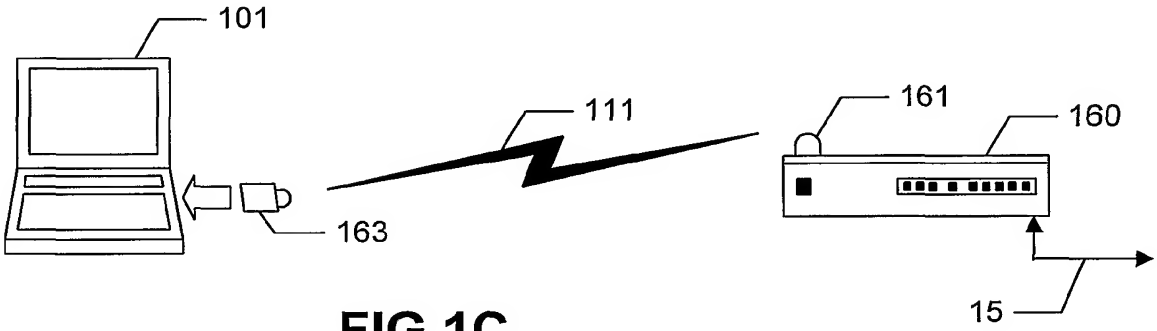

FIG 1C

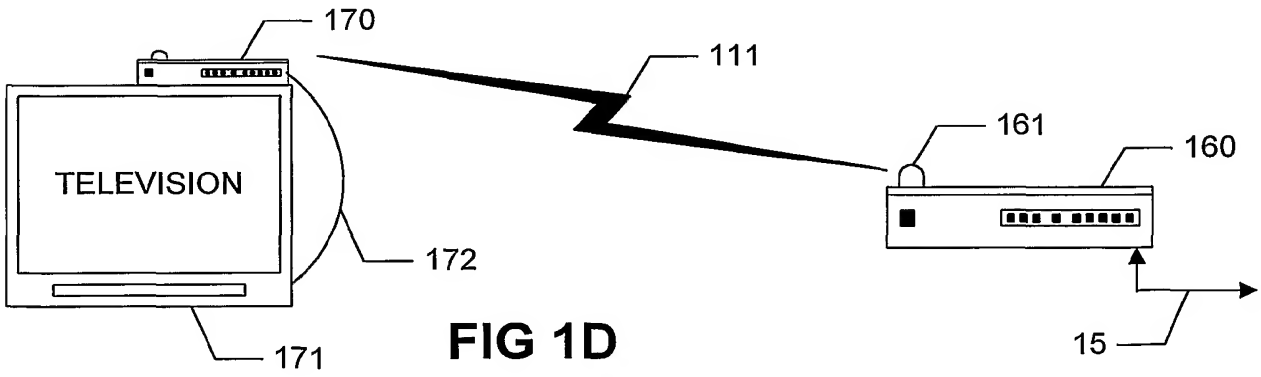

FIG 1D

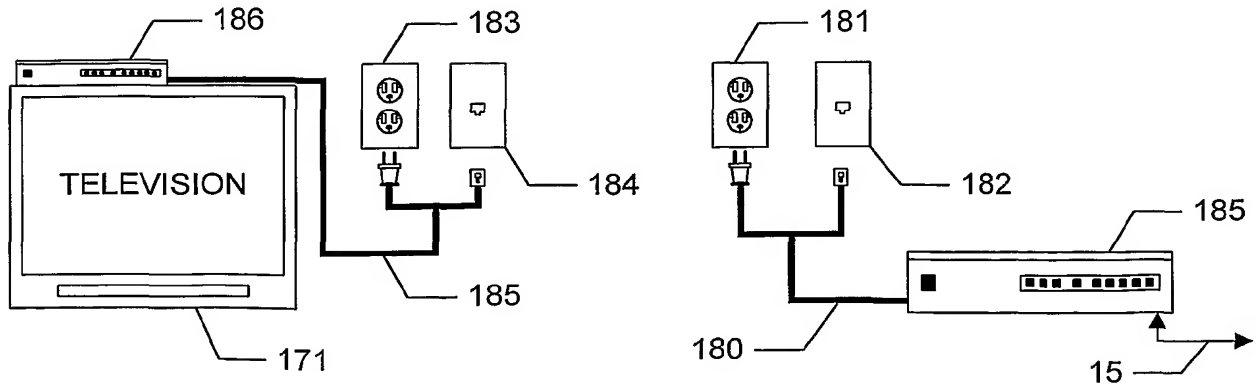

FIG 1E

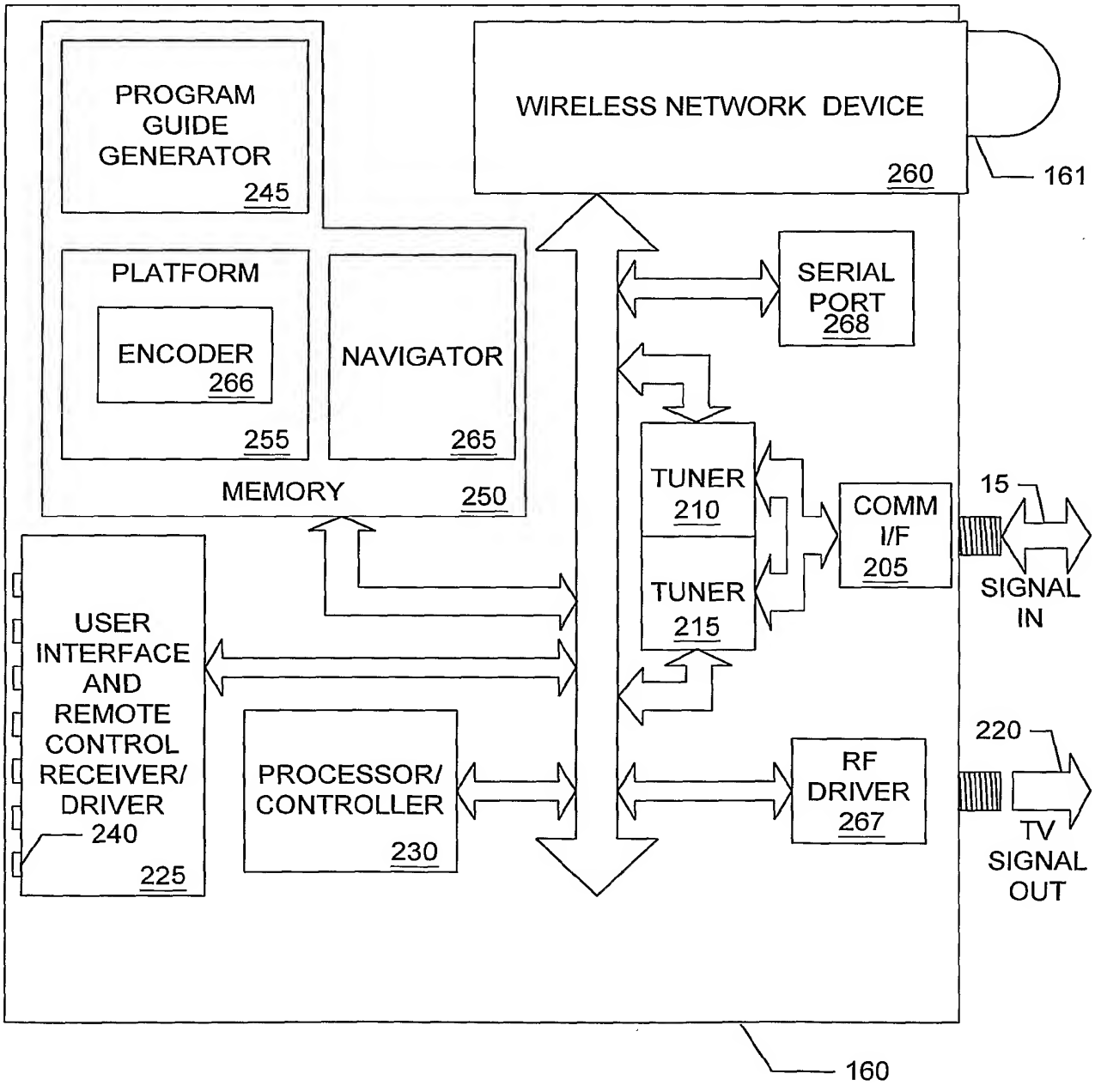
PROGRAM GUIDE GENERATOR 245
WIRELESS NETWORK DEVICE 260
161
PLATFORM
ENCODER 266
255
NAVIGATOR 265
MEMORY 250
SERIAL PORT 268
TUNER 210
TUNER 215
COMM I/F 205
15
SIGNAL IN
USER INTERFACE AND REMOTE CONTROL RECEIVER/ DRIVER 240
225
PROCESSOR/ CONTROLLER 230
RF DRIVER 267
220
TV SIGNAL OUT
160

FIG. 2

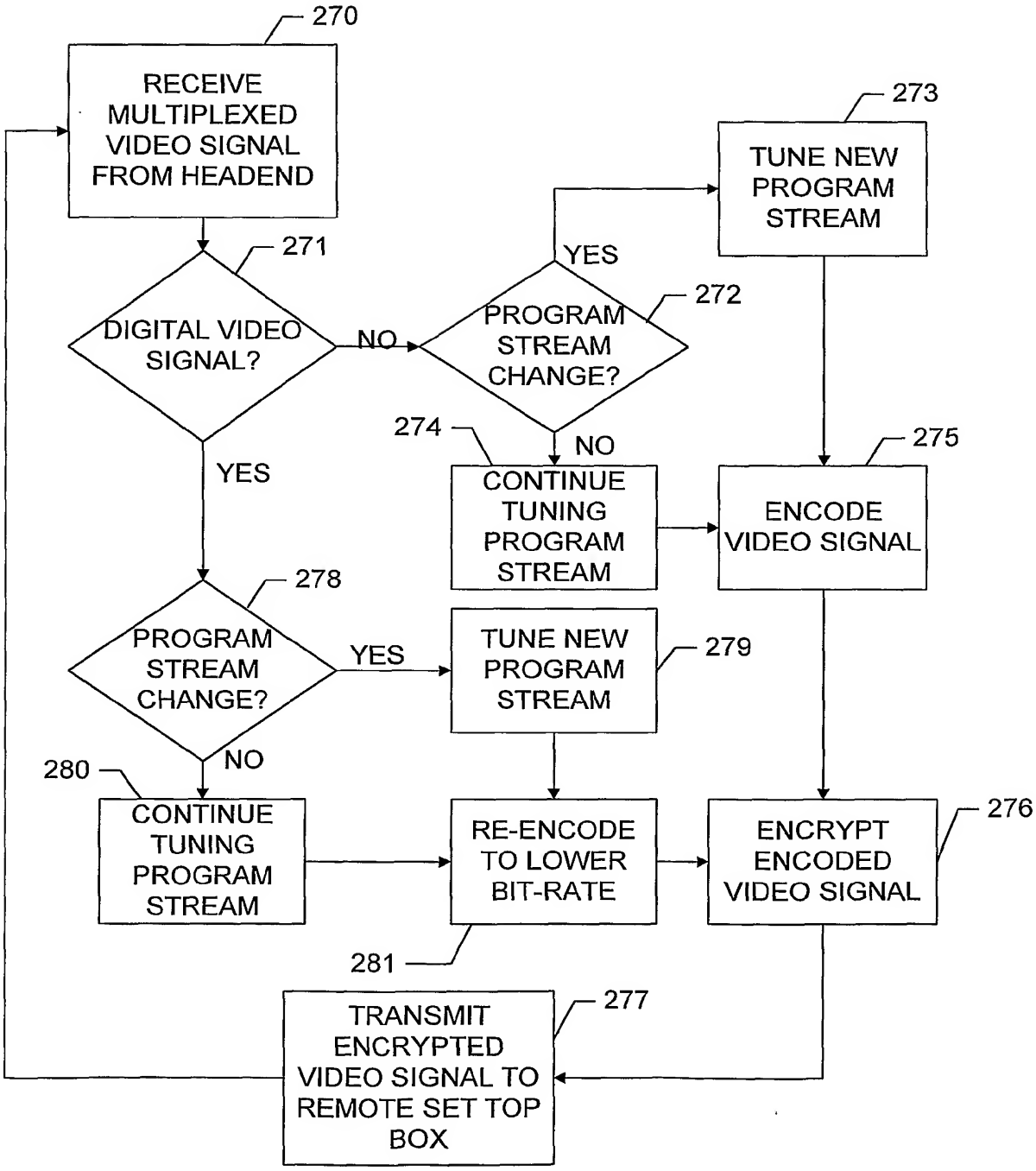
270
RECEIVE MULTIPLEXED VIDEO SIGNAL FROM HEADEND
271
DIGITAL VIDEO SIGNAL?
NO
YES
272
PROGRAM STREAM CHANGE?
YES
NO
273
TUNE NEW PROGRAM STREAM
274
CONTINUE TUNING PROGRAM STREAM
275
ENCODE VIDEO SIGNAL
278
PROGRAM STREAM CHANGE?
YES
NO
279
TUNE NEW PROGRAM STREAM
280
CONTINUE TUNING PROGRAM STREAM
RE-ENCODE TO LOWER BIT-RATE
ENCRYPT ENCODED VIDEO SIGNAL
276
281
277
TRANSMIT ENCRYPTED VIDEO SIGNAL TO REMOTE SET TOP BOX

FIG. 2A

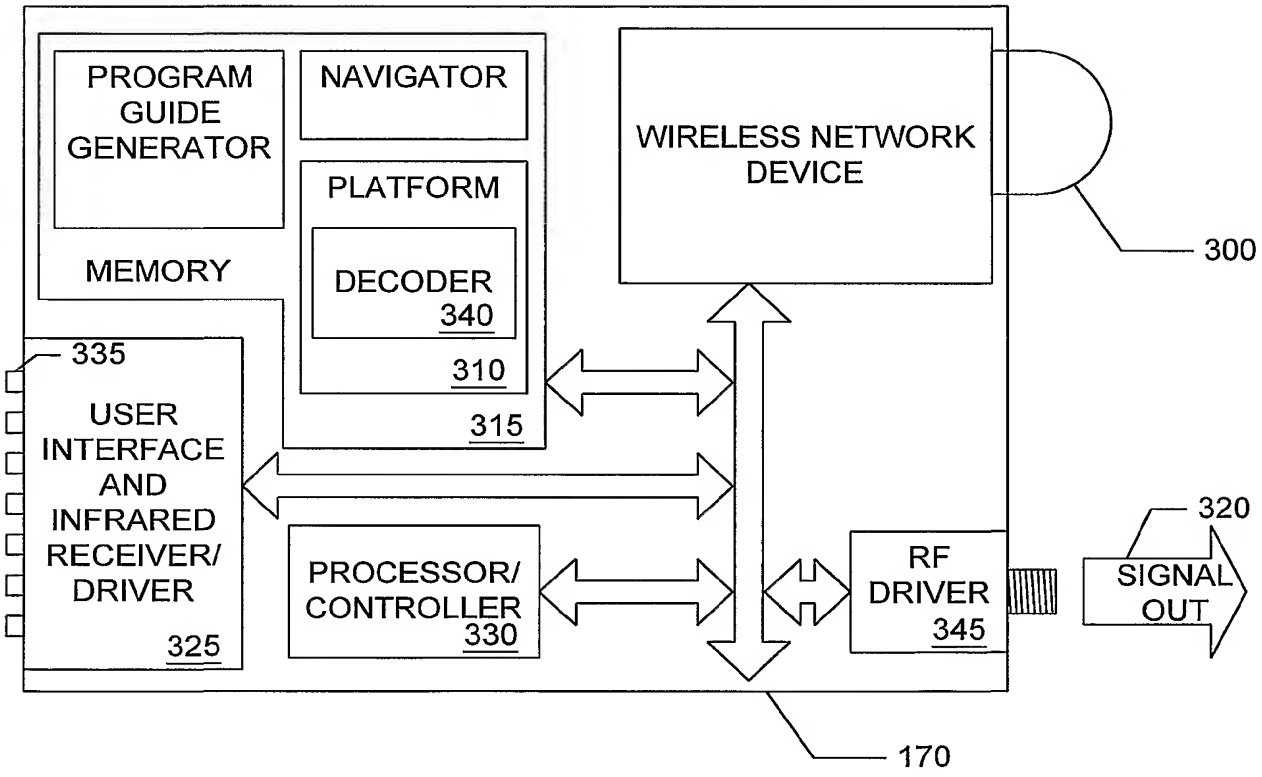
PROGRAM GUIDE GENERATOR
NAVIGATOR
PLATFORM
DECODER 340
310
MEMORY
315
WIRELESS NETWORK DEVICE
300
335
USER INTERFACE AND INFRARED RECEIVER/ DRIVER
325
PROCESSOR/ CONTROLLER 330
RF DRIVER 345
320
SIGNAL OUT
170

FIG. 3

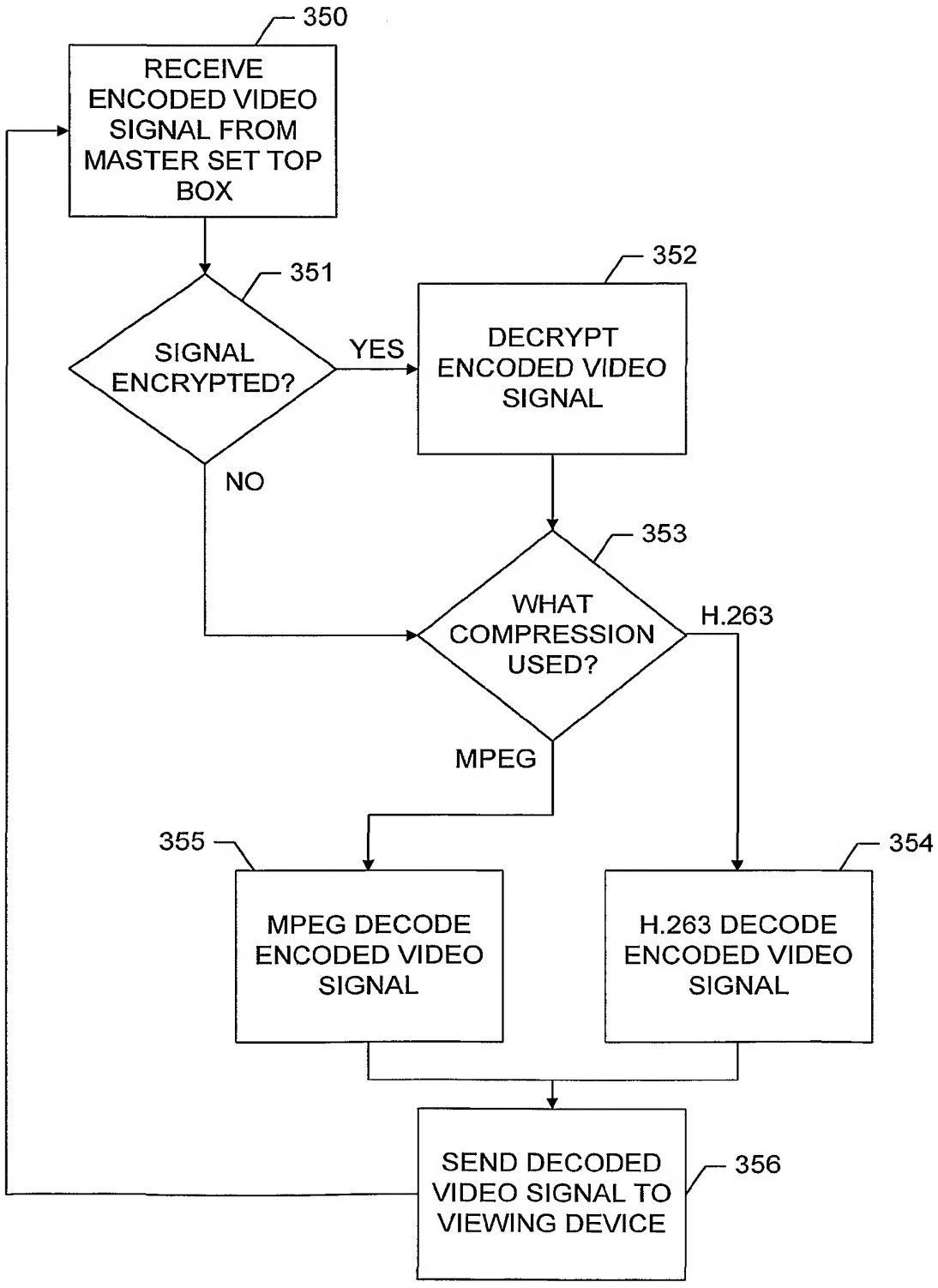
350
RECEIVE ENCODED VIDEO SIGNAL FROM MASTER SET TOP BOX
351
SIGNAL ENCRYPTED?
YES
352
DECRYPT ENCODED VIDEO SIGNAL
NO
353
WHAT COMPRESSION USED?
H.263
MPEG
355
MPEG DECODE ENCODED VIDEO SIGNAL
354
H.263 DECODE ENCODED VIDEO SIGNAL
SEND DECODED VIDEO SIGNAL TO VIEWING DEVICE
356

FIG. 3A

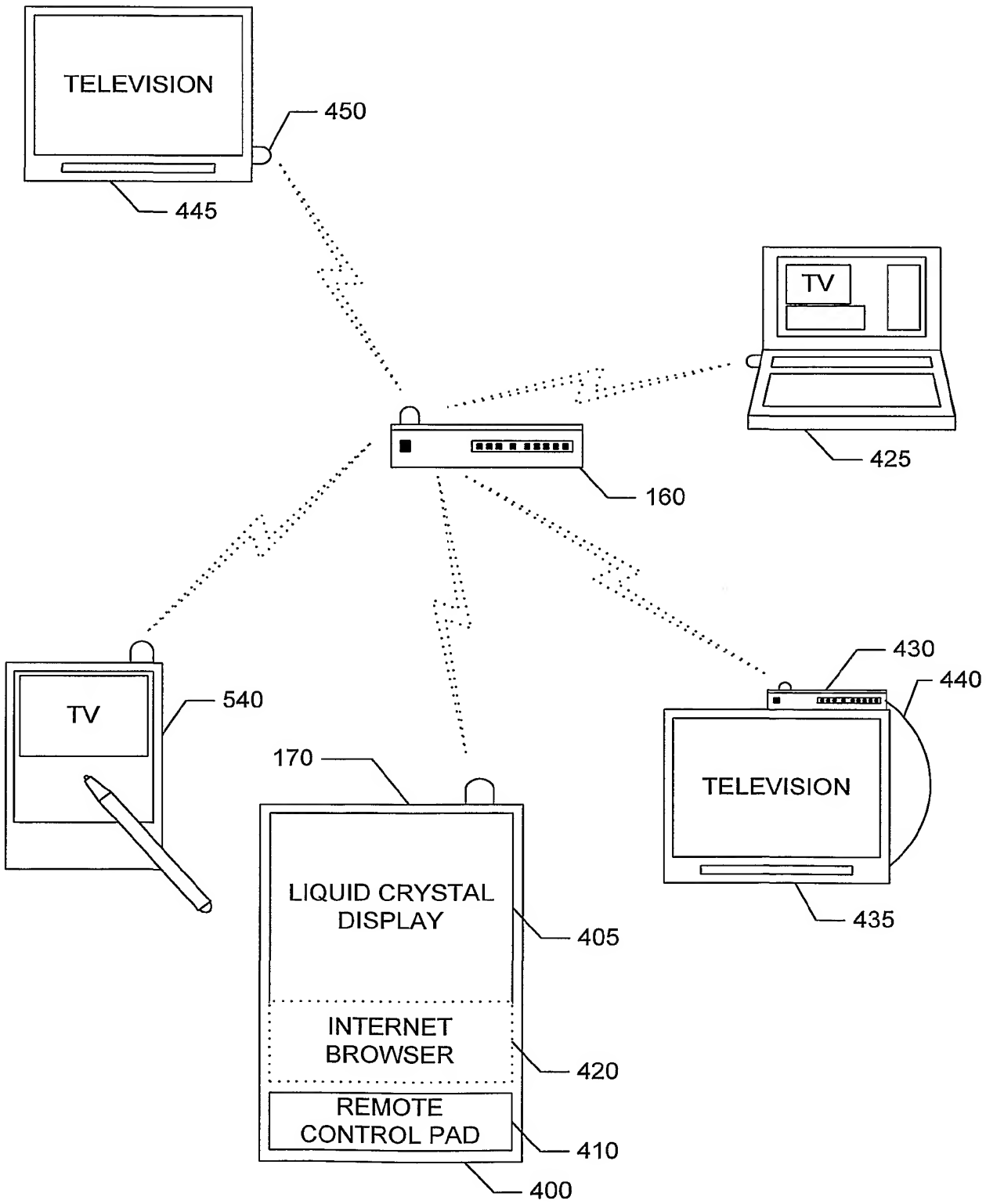
TELEVISION
450
445
TV
425
160
TV
540
170
430
440
TELEVISION
435
LIQUID CRYSTAL DISPLAY
405
INTERNET BROWSER
420
REMOTE CONTROL PAD
410
400

FIG. 4

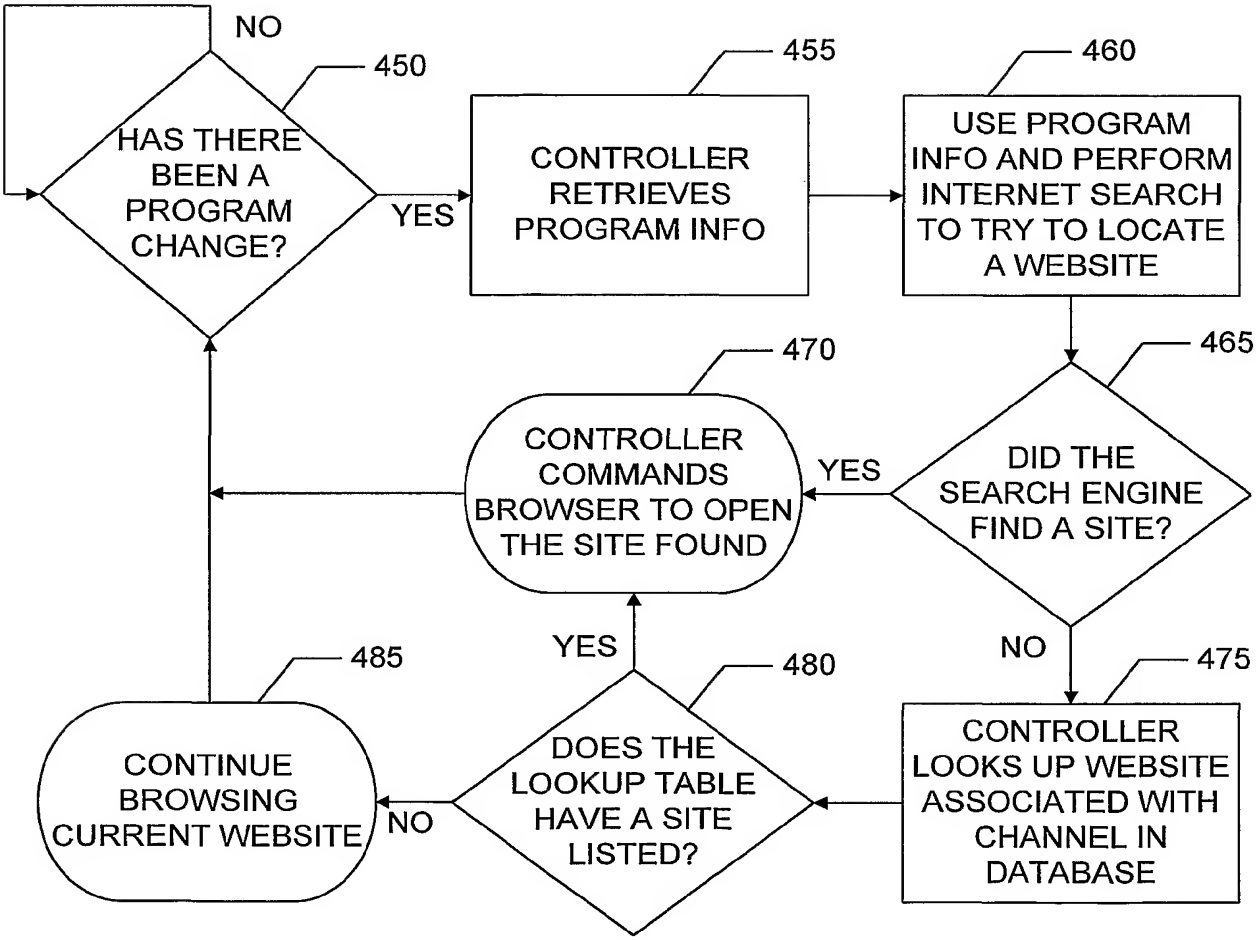
NO
450
HAS THERE BEEN A PROGRAM CHANGE?
YES
455
CONTROLLER RETRIEVES PROGRAM INFO
460
USE PROGRAM INFO AND PERFORM INTERNET SEARCH TO TRY TO LOCATE A WEBSITE
465
DID THE SEARCH ENGINE FIND A SITE?
YES
470
CONTROLLER COMMANDS BROWSER TO OPEN THE SITE FOUND
NO
475
CONTROLLER LOOKS UP WEBSITE ASSOCIATED WITH CHANNEL IN DATABASE
480
DOES THE LOOKUP TABLE HAVE A SITE LISTED?
YES
NO
485
CONTINUE BROWSING CURRENT WEBSITE

FIG. 5

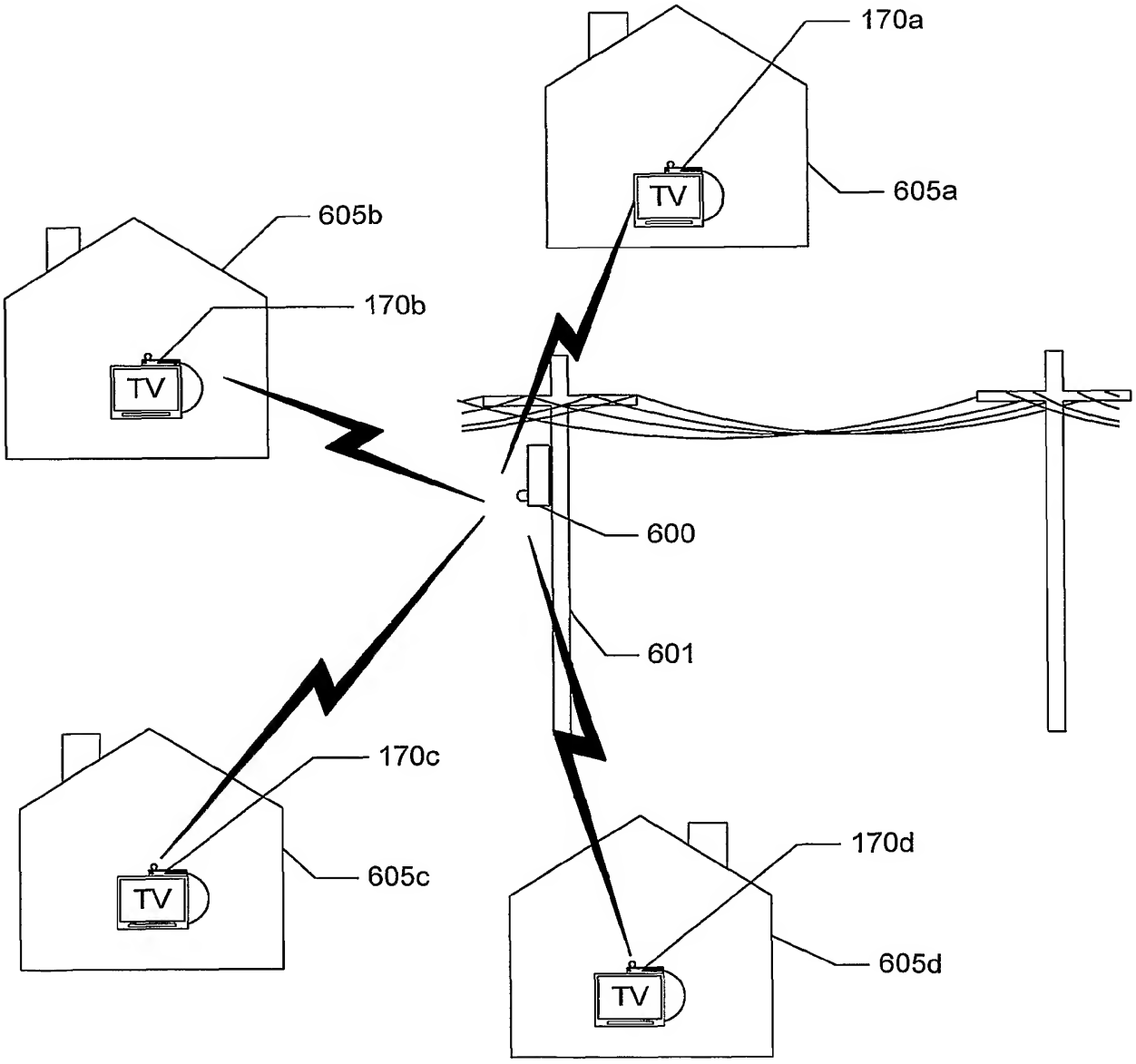

FIG. 6